

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ERICSSON INC., and CELLCO PARTNERSHIP D/B/A VERIZON WIRELESS.

Petitioners,

v.

PROCOMMINTERNATIONAL PTE. LTD.

Patent Owner.

U.S. Patent No. 7,724,521

Issue Date: May 25, 2010

Title: SYSTEMS AND METHODS FOR VENTURI FAN-ASSISTED COOLING

Inter Partes Review No.: IPR2024-01454

**PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 7,724,521
UNDER 35 U.S.C. §§ 311-319 and 37 C.F.R. §§ 42.1-.80, 42.100-.107**

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Petitioner's Exhibit List

<i>Exhibit</i>	<i>Description</i>
1001	U.S. Patent No. 7,724,521 (the "'521 Patent")
1002	Portions of prosecution history of the '521 Patent ("File History")
1003	Declaration of Petitioner's Expert
1004	U.S. Patent No. 7,028,753 ("Stern")
1005	U.S. Patent No. 5,894,407 ("Aakalu")
1006	U.S. Patent No. 6,104,003 ("Jones")
1007	U.S. Patent No. 7,027,300 ("Lord")
1008	U.S. Patent No. 7,450,382 ("Fischer")
1009	U.S. Patent No. 7,245,485 ("Morrell")
1010	Dkt. 23 Docket Control Order, <i>Procomm Int'l PTE LTD v. Verizon Commc'ns, Inc. et al.</i> , Case No. 2:24-cv-009-RWS-RSP (E.D. Tex).
1011	Intentionally left blank

I. INTRODUCTION

Pursuant to 35 U.S.C. §§ 311 *et seq.* and 37 C.F.R. §§ 42.1 *et seq.*, Ericsson Inc. and Cellco Partnership d/b/a Verizon Wireless (“Petitioners”) hereby petition for an *inter partes* review of U.S. Patent No. 7,724,521 (the “’521 Patent”) (EX-1001). Petitioners respectfully submit that Claims 1-5 and 14-20 (the “Challenged Claims”) of the ’521 Patent are unpatentable under 35 U.S.C. §103 in view of the prior art references discussed herein. This Petition demonstrates by a preponderance of the evidence that there is a reasonable likelihood that Petitioners will prevail with respect to at least one of these claims. Accordingly, it is respectfully requested that the Board institute an *inter partes* review of the ’521 Patent pursuant to 37 C.F.R. §42.108.

II. OVERVIEW

The ’521 Patent identifies “a need in the art for improved systems and methods for thermal management of telecommunications infrastructure equipment” and describes as its purported solution “systems and methods for utilizing Venturi fan-assisted cooling of electrical equipment, such as but not limited to telecommunications equipment, housed inside an enclosure.” EX-1001 2:12-14, 3:1-4. The Challenged Claims are generally directed to a method and system of cooling an enclosure housing electronic devices by (1) directing heat from the devices to a heatsink, (2) drawing a first airflow across openings of the heatsink,

and (3) using a Venturi effect created by the first airflow to draw air through the heatsink.

FIG. 3 illustrates the claimed method and FIG. 2D illustrates the system for implementing the method:

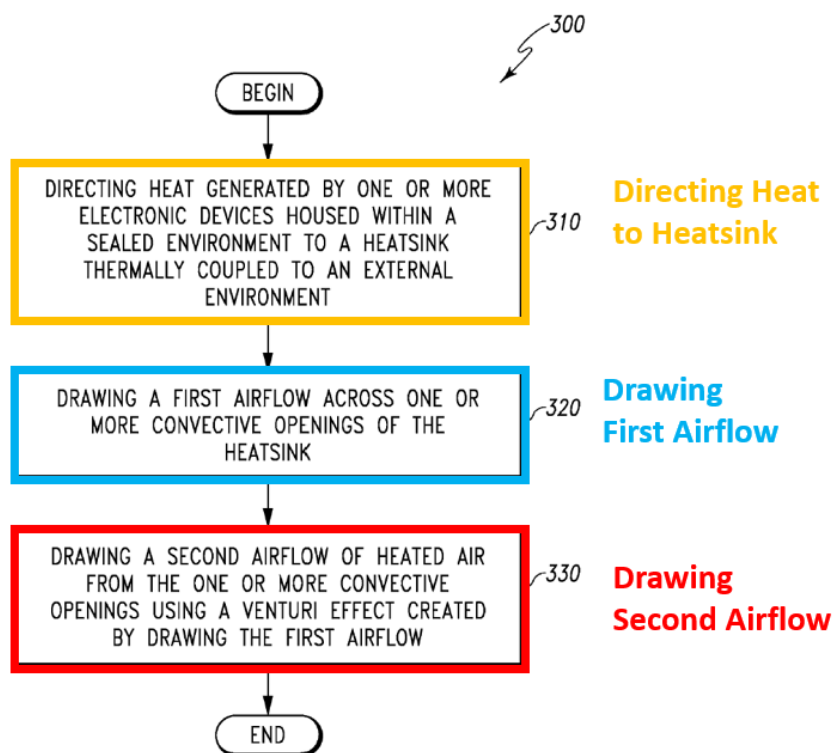
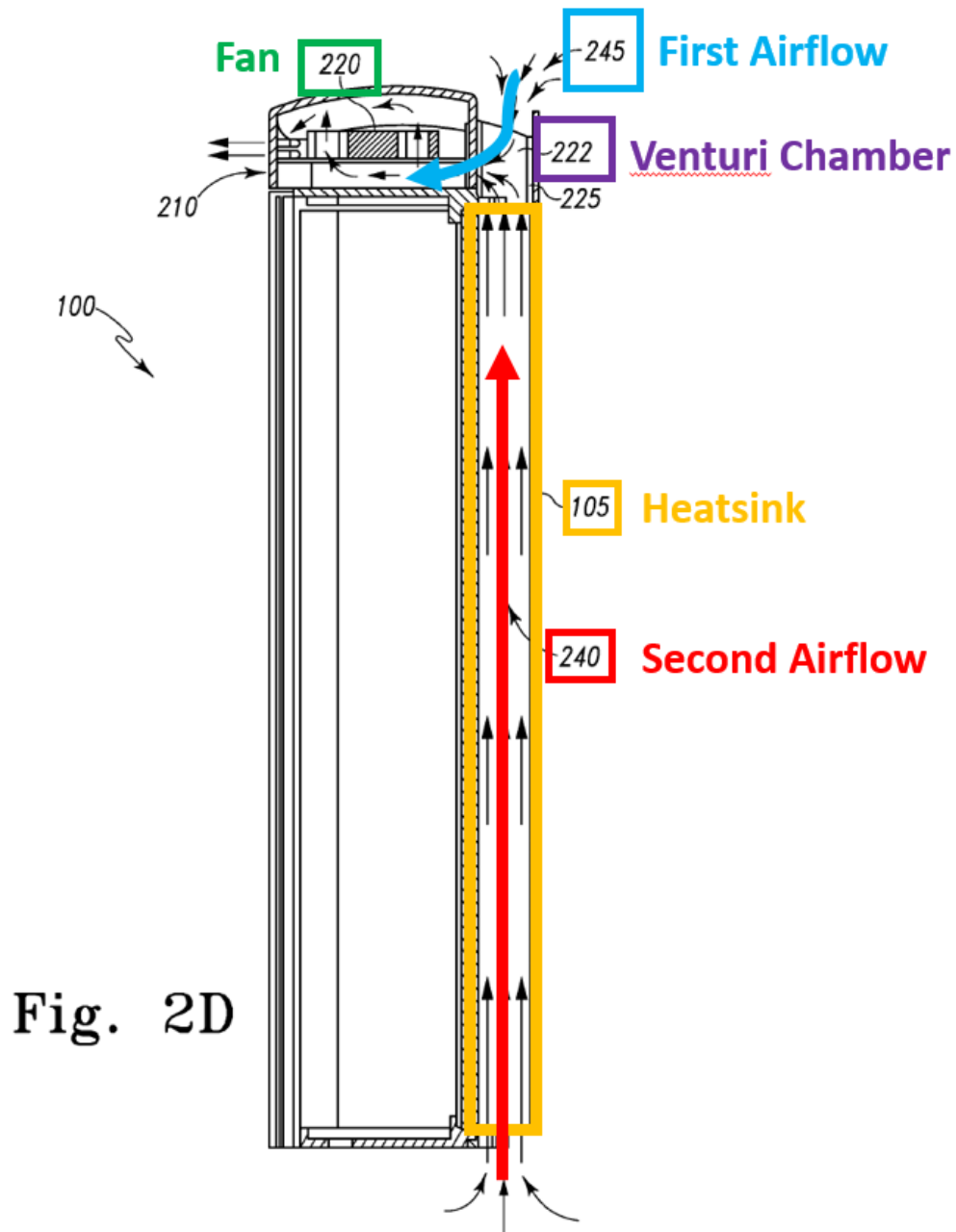


Fig. 3

EX-1001 FIG. 3¹

¹ All annotations and text in color have been added to the figures.



EX-1001 FIG. 2D

Claim 14 is directed to the embodiments shown in FIGs. 2D and 3, and reads:

14. A method for cooling a sealed environment of an enclosure for housing electronics, the method comprising:
directing heat generated by one or more electronic devices housed within a sealed environment of an enclosure to a heatsink thermally coupled to an external environment;
drawing a first airflow across one or more convective openings of the heatsink, wherein the first airflow does not flow into the one or more convective openings of the heatsink;
drawing a second airflow of heated air from the one or more convective openings using a Venturi effect created by drawing the first airflow.

EX-1001 Claim 14.

However, the Challenged Claims are merely directed to a combination of conventional components (*e.g.*, heatsinks, fans, Venturi chambers) having known physical properties used for their intended purpose to remove heat from enclosures housing electronic devices. A comparison of U.S. Patent No. 7,028,753 (“Stern”) (EX-1004) to Claim 14 demonstrates that the claimed method and system were well-known prior to the purported invention of the ’521 Patent. FIG. 8 of Stern is annotated below to show the elements recited in Claim 14:

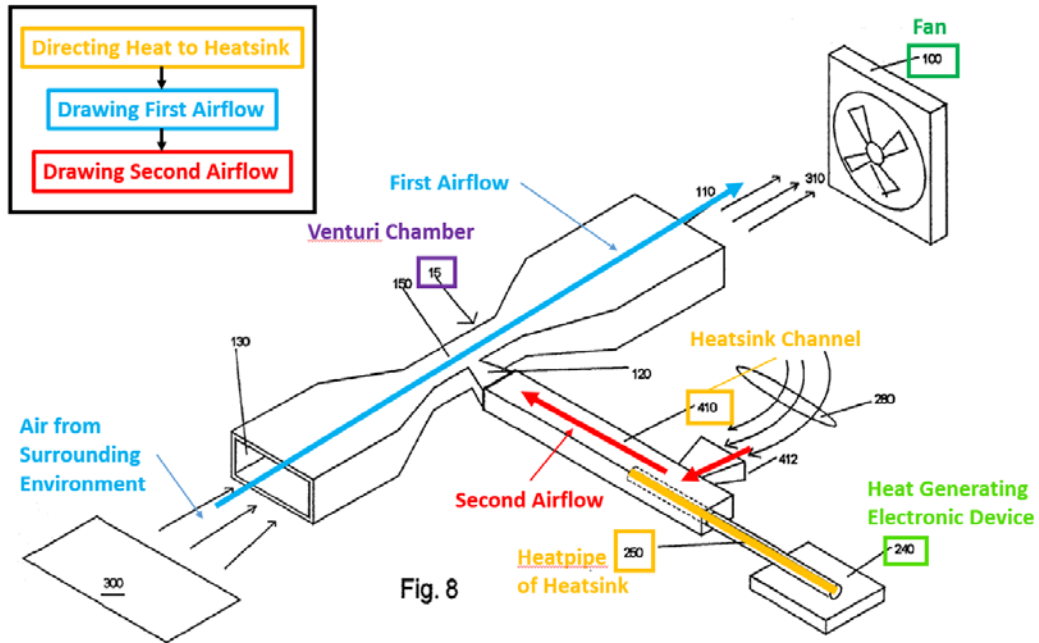
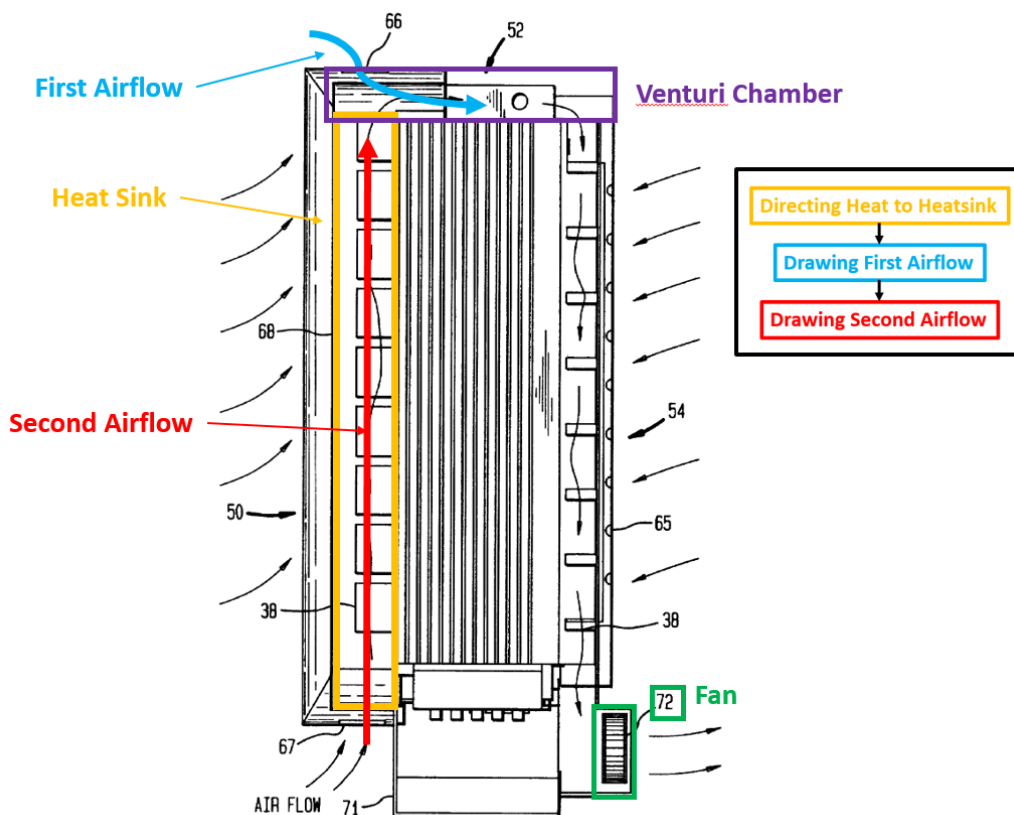


Fig. 8

EX-1004 FIG. 8; EX-1003 ¶32.

U.S. Patent No. 5,894,407 (Aakalu) (EX-1005) also discloses the claimed method and the system. FIG. 10 of Aakalu is annotated below to show the elements recited in Claim 14:



EX-1005 FIG. 10; EX-1003 ¶33.

Sterner and Aakalu each demonstrate that the purported invention recited in the Challenged Claims was well-known at the time of the '521 Patent and is unpatentable as set forth in Grounds 1-3 below. EX-1003 ¶34.

III. GROUNDS FOR STANDING (37 C.F.R. § 42.104(A))

Petitioners certify that the '521 Patent for which review is sought is available for *inter partes* review and that Petitioners are not barred or estopped from requesting an *inter partes* review of the Challenged Claims on the grounds set forth herein. 37 C.F.R. § 42.104(a). This Petition is filed pursuant to 37 C.F.R. § 42.106(a).

IV. REASONS FOR THE REQUESTED RELIEF

As set forth in this Petition and in the attached Declaration of Petitioners' Expert (EX-1003), the methods and systems for cooling electronic devices as claimed in the '521 Patent were obvious over the prior art to a person of ordinary skill in the art ("POSA") at the time of the invention.

V. BACKGROUND

A. Summary of the '521 Patent

The '521 Patent is titled "Systems and Methods for Venturi Fan-Assisted Cooling" and is directed to a method for cooling enclosures housing electronic devices using a fan-driven Venturi effect to draw air through a heatsink, and a system implementing the cooling method. EX-1001 Title, Abstract, 2:18-21; EX-1003 ¶35.

The '521 Patent explains that "in the field of telecommunications, there is a trend to reduce both the size and the expenses associated with infrastructure equipment" while retaining all the functionality of legacy equipment resulting in "thermal management challenges for dissipating heat generated by telecommunications infrastructure equipment." EX-1001 1:65-2:14; EX-1003 ¶36. As a solution, the '521 Patent describes systems and methods for cooling electrical equipment housed within an enclosure having air flowing through a heatsink using a fan to both (1) draw air from openings of the heatsink and (2) draw air past the openings of the heatsink to produce a Venturi effect, the combination of which

“generates an increased airflow through the heatsink which in turn draws in relatively cool air in from the bottom side ... of the heatsink.” EX-1001 6:8-15; EX-1003 ¶36.

FIG. 3 shows a “flow chart illustrating a method 300 of one embodiment of the present invention for cooling an enclosure for housing electronics.” EX-1001 5:39-41; EX-1003 ¶37.

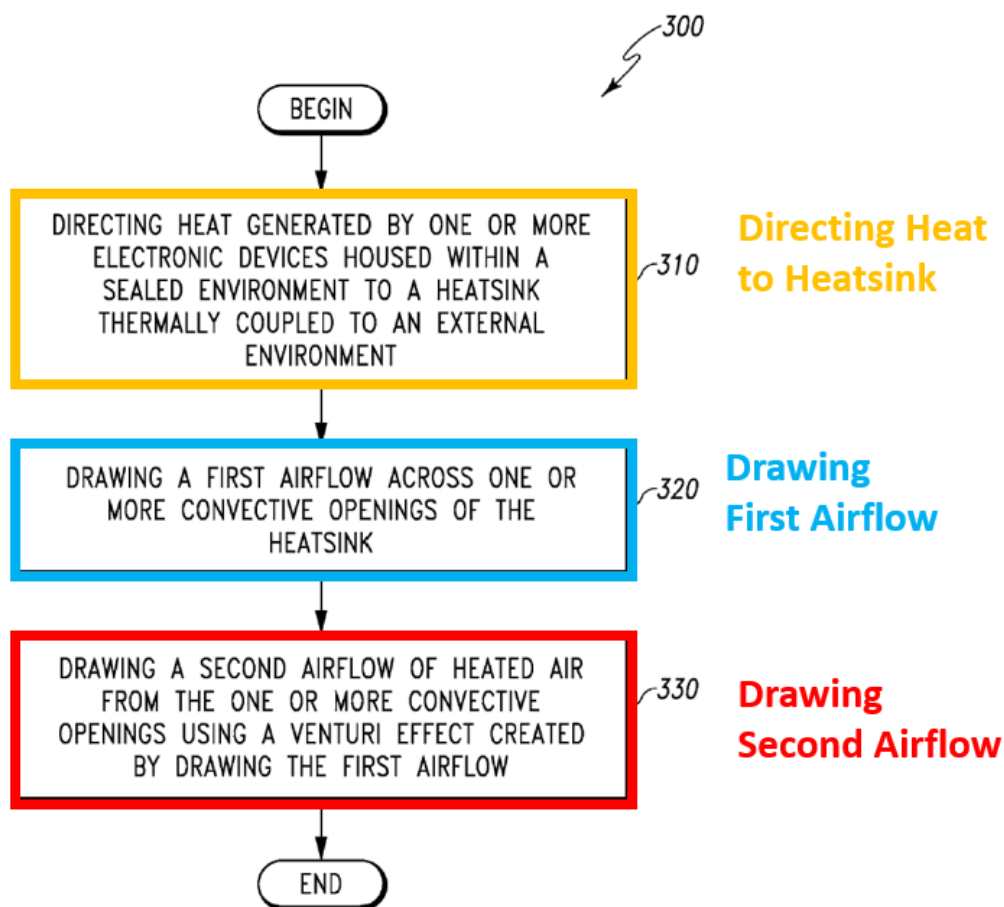


Fig. 3

EX-1001 FIG. 3; EX-1003 ¶37.

The '521 Patent explains that the method begins at 310 (**gold**) with directing heat generated by one or more electronic devices to a heatsink thermally coupled to an external environment. EX-1001 5:41-43; EX-1003 ¶38. The method proceeds to 320 (**blue**) with drawing a first airflow across one or more convective openings (air ducts/channels) of the heatsink, and to 330 (**red**) with drawing a second airflow of heated air from the one or more convective openings of the heatsink using a Venturi effect created by drawing the first airflow. EX-1001 5:61-65; EX-1003 ¶38. The '521 Patent further explains that

the airflow flowing up from the heatsink's convective openings will be heated by the heat dissipated from high powered internal electronics and thus will be significantly more buoyant than the ambient first airflow. As a result, drawing the first airflow across the convective openings of the heatsink will establish a Venturi affect [sic] which will pull in more air through the heat sink than would flow naturally due to natural convention.

* * *

The combination of drawing both the heated airflow from the heatsink and the ambient airflow from above is what produces the Venturi effect that generates an increased airflow through the heatsink which in turn draws in relatively cool ambient air in from the bottom side convective openings of the heatsink.

EX-1001 5:66-6:6, 6:8-15; EX-1003 ¶38.

The Challenged Claims include independent Claims 14 and 19 directed to the method of cooling an enclosure housing electronics. A side-by-side comparison of Claims 14 and 19 is provided below:

Claim 14	Claim 19
[pre] A method for cooling a sealed environment of an enclosure for housing electronics, the method comprising:	[pre] A method for cooling a sealed environment of an enclosure for housing electronics, the method comprising:
[a] directing heat generated by one or more electronic devices housed within a sealed environment of an enclosure to a heatsink thermally coupled to an external environment;	[a] directing heat generated by one or more electronic devices housed within a sealed environment of an enclosure to a heatsink thermally coupled to an external environment;
[b] drawing a first airflow across one or more convective openings of the heatsink, wherein the first airflow does not flow into the one or more convective openings of the heatsink;	[b] when a temperature exceeds a first predetermined threshold, operating a fan to draw a first airflow across one or more convective openings of the heatsink and
[c] drawing a second airflow of heated air from the one or more convective openings using a Venturi effect created by drawing the first airflow.	[c] [draw] a second airflow of heated air from the one or more convective openings of the heatsink using a Venturi effect created by drawing the first airflow,

	wherein the first airflow does not flow into the one or more convective openings of heatsink;
	[d] when the temperature does not exceed a second predetermined threshold, allowing a natural circulation airflow to flow from the one or more convective openings of the heatsink by not operating the fan.

As shown above, Claims 14 and 19 are each directed to the steps ([a], [b], and [c]) described in the flow chart of FIG. 3, with Claim 19 adding an additional step of turning the fan on/off based on temperature. The dependent method claims are directed to specifics related to the control and position of the fan.

The '521 Patent also describes an apparatus for implementing the method. FIGs. 1A–1D are provided as “diagrams illustrating an enclosure 100 of one embodiment of the present invention.” EX-1001 3:5-6; EX-1003 ¶41. FIG. 1D illustrates the enclosure with the doors open showing the area where the electronic devices are housed:

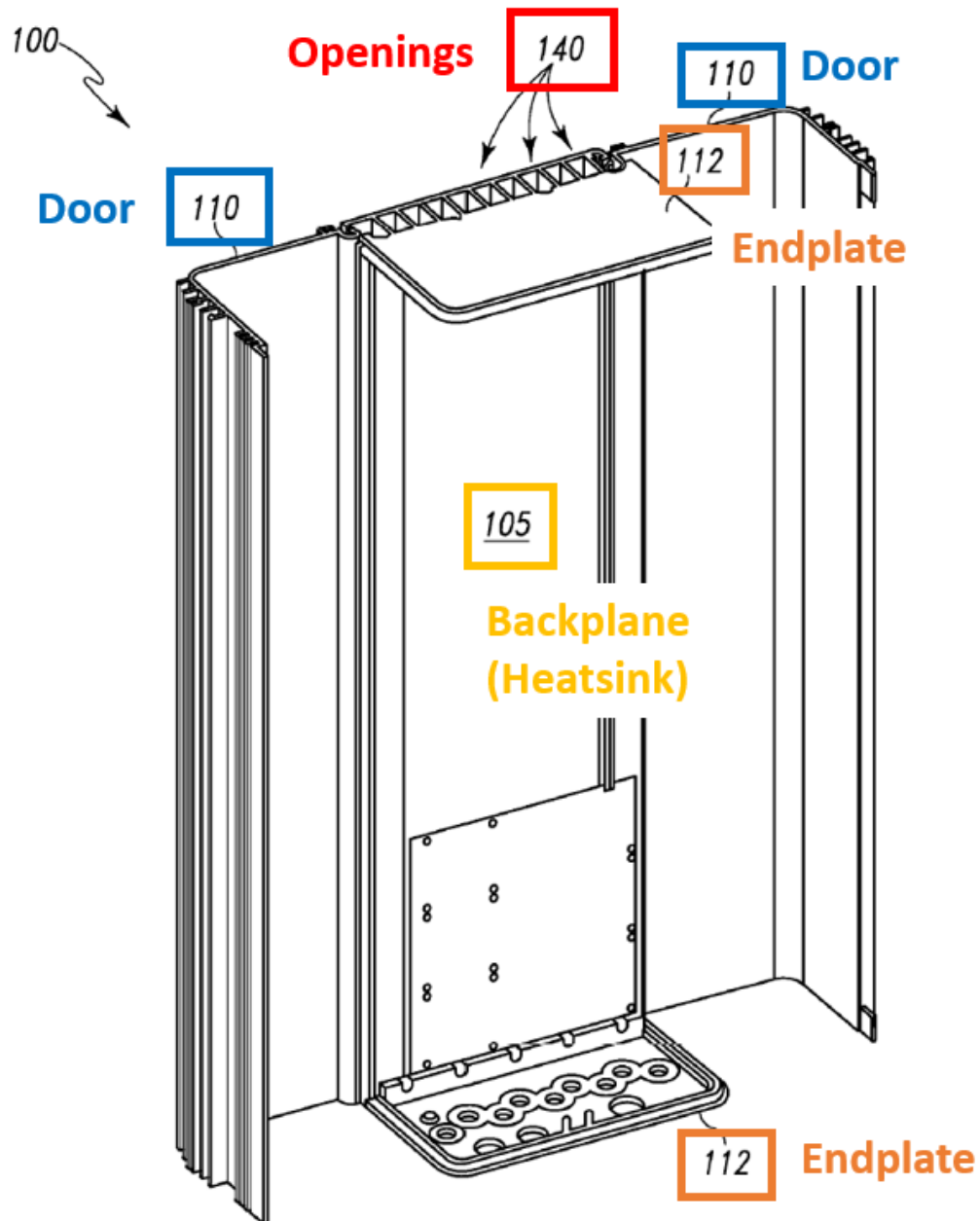
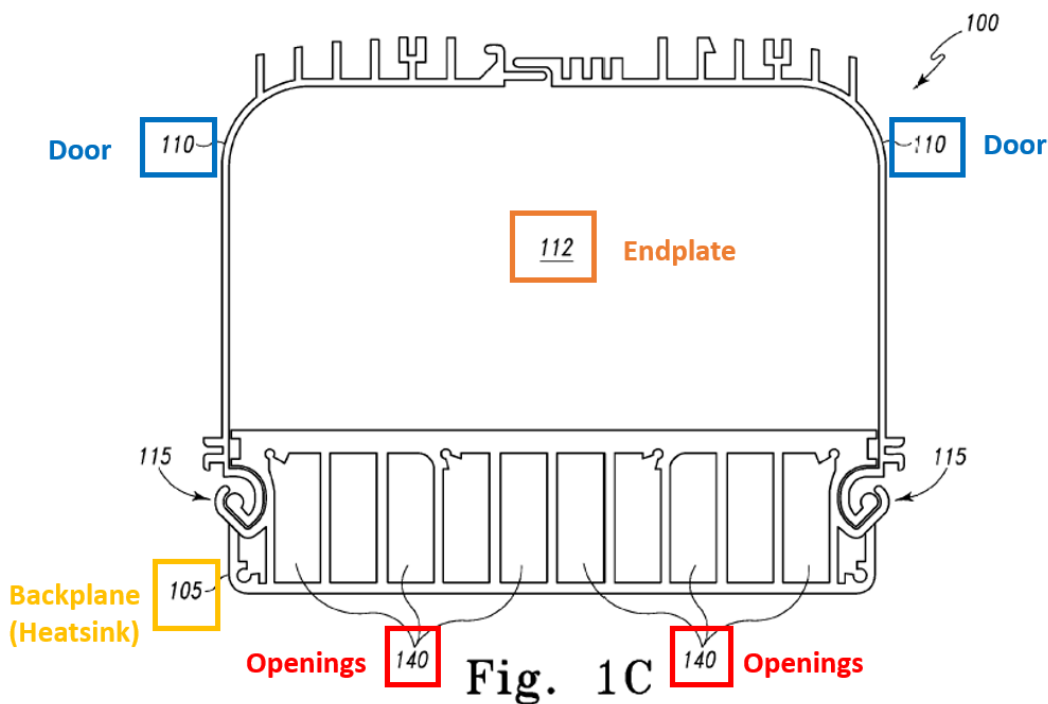


Fig. 1D

EX-1001 FIG. 1D; EX-1003 ¶41

FIG. 1C illustrates an end view of the enclosure shown in FIG. 2D, but with the doors closed:



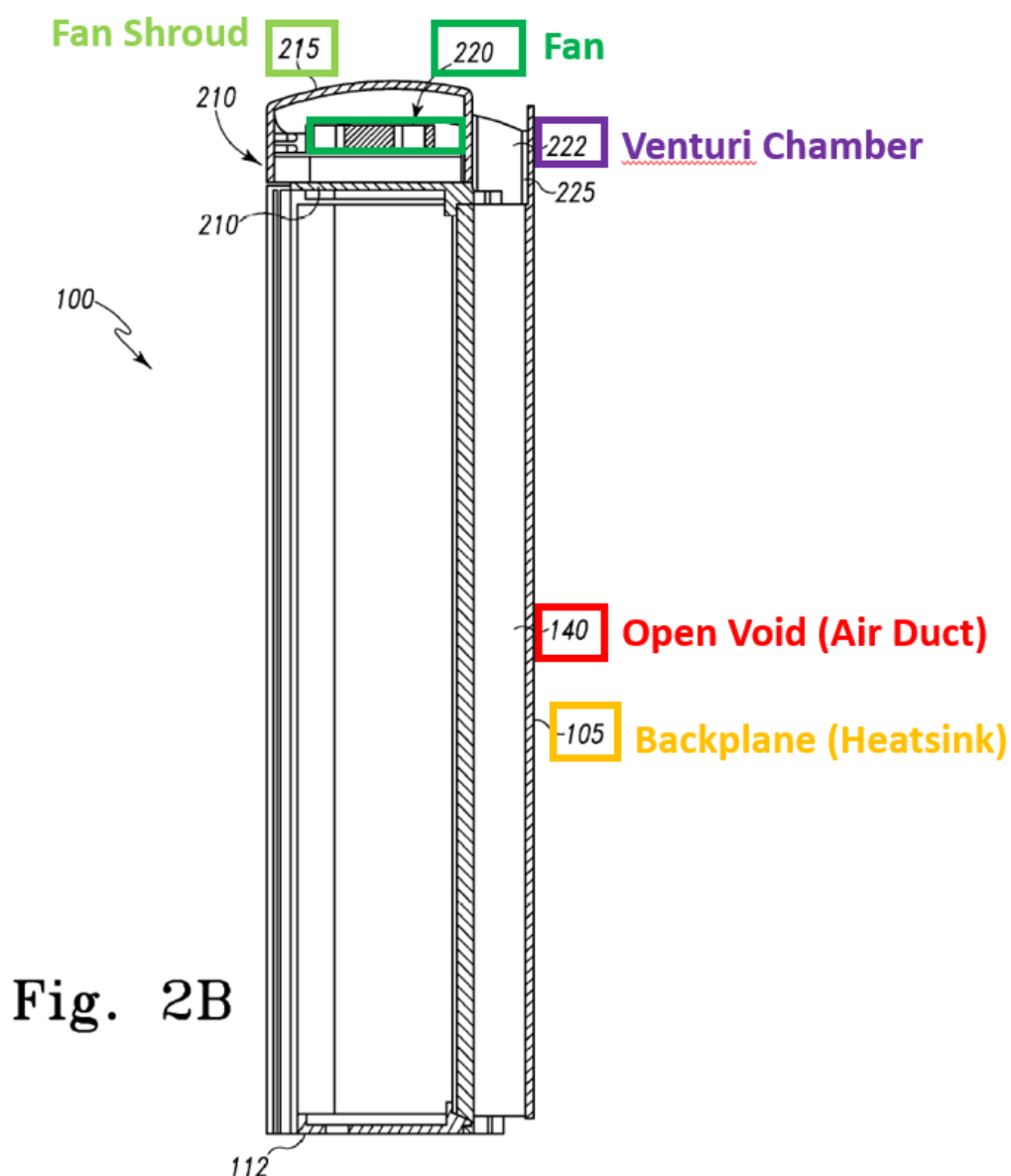
EX-1001 FIG. 1C; EX-1003 ¶42

The '521 Patent explains that enclosure 100 comprises a structural backplane 105 (gold), two doors 110 (blue) that each pivot around respective hinges 115, and two endplates 112 (orange) attached respectively to the ends of structural backplane 105 so that when doors 110 are closed (as illustrated in FIG. 1C), a sealed environment is created within enclosure 100. The '521 Patent discloses that in in some embodiments, the sealed environment is not weatherproof, but in alternate embodiments, a weatherproof sealed environment is provided. EX-1001 3:4-13; EX-1003 ¶43.

The '521 Patent further explains that backplane 105 functions as a heatsink for internal electronics 130 (shown in FIGs. 1A and 1B) housed within enclosure

100. EX-1001 3:29-44. Backplane 105 includes a plurality of convective openings 140 (**red**) forming open voids (air ducts) that run the length of backplane 105. EX-1001 3:48-54; EX-1003 ¶44.

The '521 Patent provides FIGs. 2A-2E as illustrating “a Venturi assisted cooling unit for the enclosure of one embodiment of the present invention.” EX-1001 2:44-46; EX-1003 ¶45. FIG. 2B illustrates a cutaway view of the embodiment:



EX-1001 FIG. 2B; EX-1003 ¶45.

The '521 Patent explains that a fan assisted cooling unit 210 may be positioned at the top of enclosure 100. Fan assisted cooling unit 210 comprises fan shroud 215 (light green) and at least one electrical fan 220 (green). EX-1001 4:11-16. Cooling unit 210 further comprises a Venturi chamber 222 (purple)

formed from continuous wall 225 connected on each end to fan shroud 215. As illustrated in FIG. 2C, fan 220 is placed in an offset position outside of Venturi chamber 222 so as to not impede the natural circulation of air through convective openings 140 when fan 220 is not operating. EX-1001 4:28-31; EX-1003 ¶46.

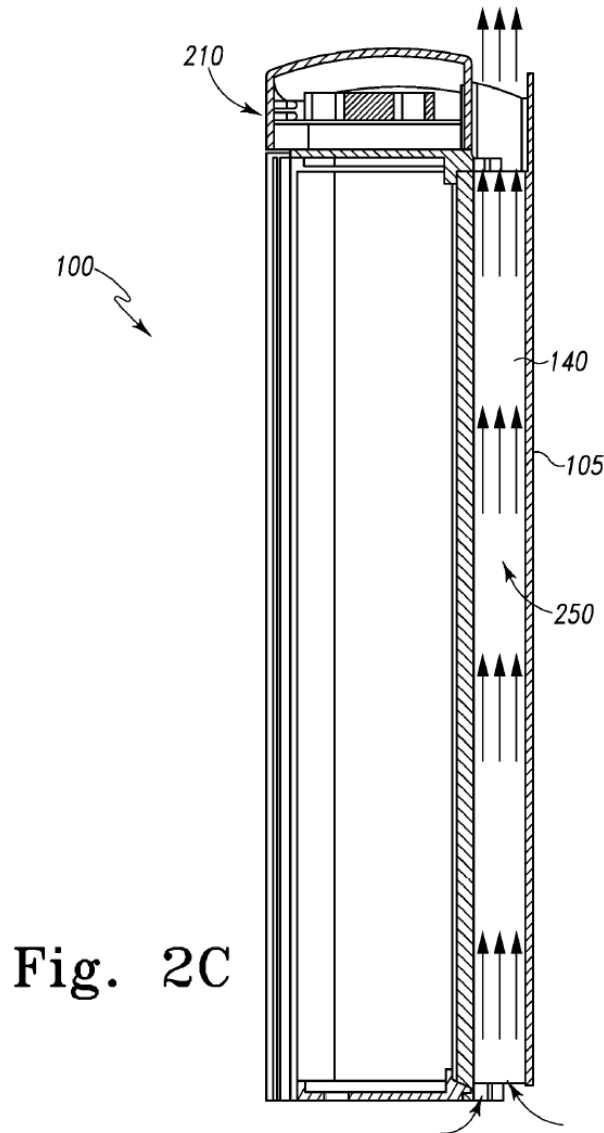


Fig. 2C

EX-1001 FIG. 2C; EX-1003 ¶46.

FIG. 2D illustrates the air flow during operation of fan 220:

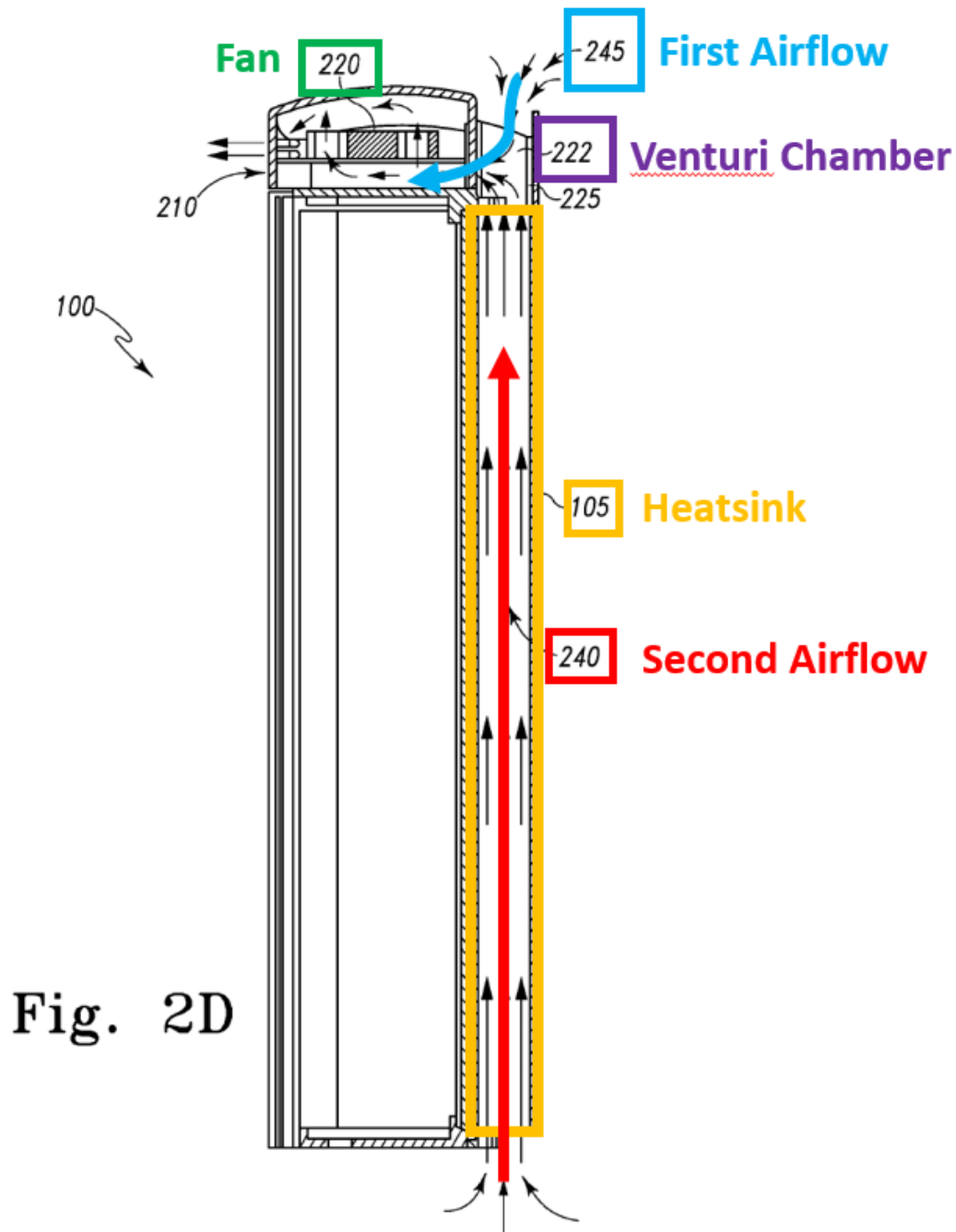


Fig. 2D

EX-1001 FIG. 2D; EX-1003 ¶47.

The '521 Patent explains that fan 22 (green) draws air from Venturi chamber 222 (purple), and due to the positioning of wall 225, air drawn into fan

220 must flow into Venturi chamber 222 either through the convective openings 140 of backplane 105 (shown generally by second airflow 240 (**red**)), or drawn in from the ambient environment above Venturi chamber 222 (shown generally by first airflow 245 (**blue**)). The second airflow 240 (**red**) flowing through the openings 140 of backplane (heatsink) 105 (**gold**) is heated by the heat dissipated from high powered internal electronics (130). The '521 Patent further explains that fan 220 pulls in the hot buoyant air off the top of backplane 105 and at the same time also pulls in ambient air from the top of Venturi chamber 222 such that the ambient air coming in from the top of Venturi chamber 222 is directed across the heated airflow drawn from backplane 105. According to the '521 Patent, drawing the first airflow 245 (**blue**) from above into Venturi chamber 222 and through fan 220 produces a Venturi effect increasing airflow in the heated second airflow 240 (**red**) through backplane (heatsink) 105. EX-1001 4:35-45; EX-1003 ¶48.

The Challenged Claims include independent Claim 1 directed to a cooling unit for an enclosure housing electronics:

Claim 1
[pre] A cooling unit for an enclosure housing electronics, the cooling unit comprising:
[a] a fan shroud having at least one electrical fan; and
[b] a Venturi chamber having
[b.1] a first inlet for receiving a heated airflow from a heatsink,

[b.2] a second inlet for receiving an airflow from a surrounding environment, and

[b.3] an outlet coupled to the fan shroud, the fan drawing air from the Venturi chamber via the outlet when the fan is on;
--

[b.4] wherein the Venturi chamber comprises a wall for directing the airflow air from the surrounding environment in from the second inlet and across the heated airflow from the heatsink in a manner to as to draw the heated airflow through the heatsink using a Venturi effect, when the fan is on.
--

As shown above, Claim 1 recites a cooling device having [a] a shroud and fan, and [b.1–b.4] a specific configuration of a Venturi chamber. The dependent claims are directed to various configurations of the cooling unit.

B. Prosecution History

In a first Office Action, Claims 1-13 directed to a cooling unit (Claims 1-5) and an enclosure having a cooling unit (Claims 6-13) were either allowed or indicated to be allowable if amended to overcome Section 112(2) rejections.

Claims 14-20, directed to a method of cooling electronics, were rejected as obvious over Aakalu (US5894407) in view of Dellapi (US6142595). EX-1002 52-53.

Applicant amended several claims in response to the Section 112 rejections. EX-1002 25-29, 33-34. Applicant also amended independent Claims 14 and 19 in response to the obviousness rejection:

14. (Currently Amended) A method for cooling a sealed environment of an enclosure for housing electronics, the method comprising:
- directing heat generated by one or more electronic devices housed within a sealed environment of an enclosure to a heatsink thermally coupled to an external environment;
 - drawing a first airflow across one or more convective openings of the heatsink, wherein the first airflow does not flow into the one or more convective openings of the heatsink;
 - drawing a second airflow of heated air from the one or more convective openings using a Venturi effect created by drawing the first airflow.

EX-1002 28

19. (Currently Amended) A method for cooling a sealed environment of an enclosure for housing electronics, the method comprising:
- directing heat generated by one or more electronic devices housed within a sealed environment of an enclosure to a heatsink thermally coupled to an external environment;
 - when a temperature exceeds a first predetermined threshold, operating a fan to draw a first airflow across one or more convective openings of the heatsink and a second airflow of heated air from the one or more convective openings of the heatsink using a Venturi effect created by drawing the first airflow, wherein the first airflow does not flow into the one or more convective openings of heatsink;
 - when the temperature does not exceed a second predetermined threshold, allowing a natural circulation airflow to flow from the one or more convective openings of the heatsink by not operating the fan.

EX-1002 29

In its Remarks, Applicant referenced an interview with the Examiner wherein the Examiner agreed that the amendments to Claims 14 and 19 would overcome the obviousness rejection. EX-1002 31-35.

The Office subsequently issued a Notice of Allowance and the Challenged Claims issued in the '521 Patent as amended.

C. Claim Construction

Each claim term herein should be given its plain and ordinary meaning. No specific construction of any claim term is required because the prior art relied on herein meets the claim terms under any reasonable construction.

This interpretation is only applicable to the *inter partes* review sought herein and should not be construed as constituting, in whole or in part, Petitioners' own interpretation of any claims for any other purposes, including any litigation. Accordingly, Petitioners expressly reserve the right to present an interpretation of a claim term in other proceedings, which is different, in whole or in part, from that presented in this Petition.

D. Priority Date of the Challenged Claims

The application that issued as the '521 Patent was filed Jun. 11, 2008 which is the date applied for purposes of this Petition.

E. Person of Ordinary Skill in the Art

A POSA in 2008 would have been familiar with thermal management of electronic devices, including devices housed within a sealed enclosure. EX-1003 ¶54. A POSA would have gained knowledge of these concepts through a mixture of training and work experience, such as by having a Bachelor's degree mechanical engineering and four years of experience; or by obtaining a Master's degree in mechanical engineering, but having only one to two years of experience; or by

having no formal education but experience in such systems of at least eight years.

EX-1003 ¶54.

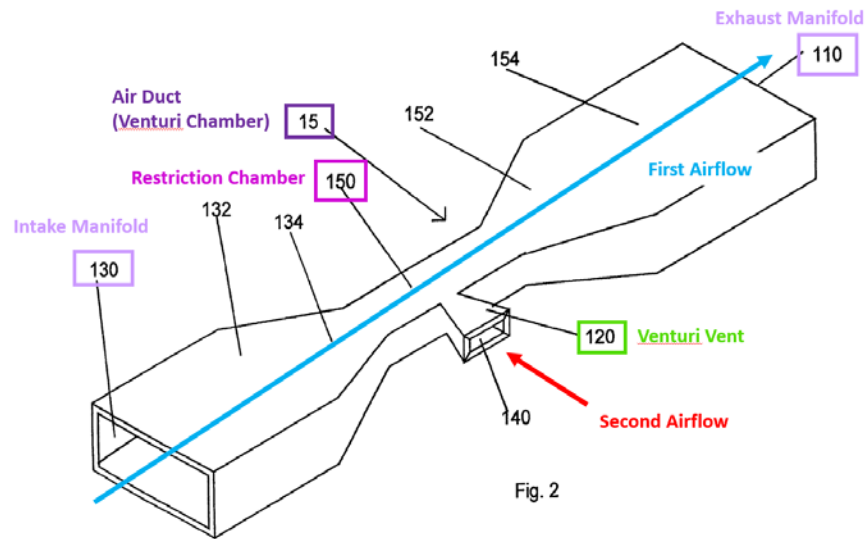
F. State of the Art

The following section describes the state of the art in cooling systems for electronics housed in enclosures as of the filing of the '521 Patent. EX-1003 ¶55.

The prior art references, and the discussions of what was known to a POSA, provide the factual support for the general description of the state of the art and provide additional motivation to modify or combine the references. Accordingly, these references should be considered by the Board.

1. The Venturi Effect and Its Use in Cooling Electronics

The purported invention of the '521 Patent is the use of a fan-driven Venturi effect to draw an airflow in a forced convection cooling system for electronic enclosures. A POSA understood the Venturi effect was a well-known observation that the rate of fluid flow in a closed system, such as a pipe, increases as the fluid encounters a constricted region, and that this Venturi effect is based on Bernoulli's principle. EX-1003 ¶56. A POSA also understood that it was common and well-known to use the Venturi effect to increase the airflow used to cool electronics. For example, Sterner illustrates an air duct (Venturi chamber) used in drawing an airflow to cool electronics.



EX-1004 FIG. 2; EX-1003 ¶56

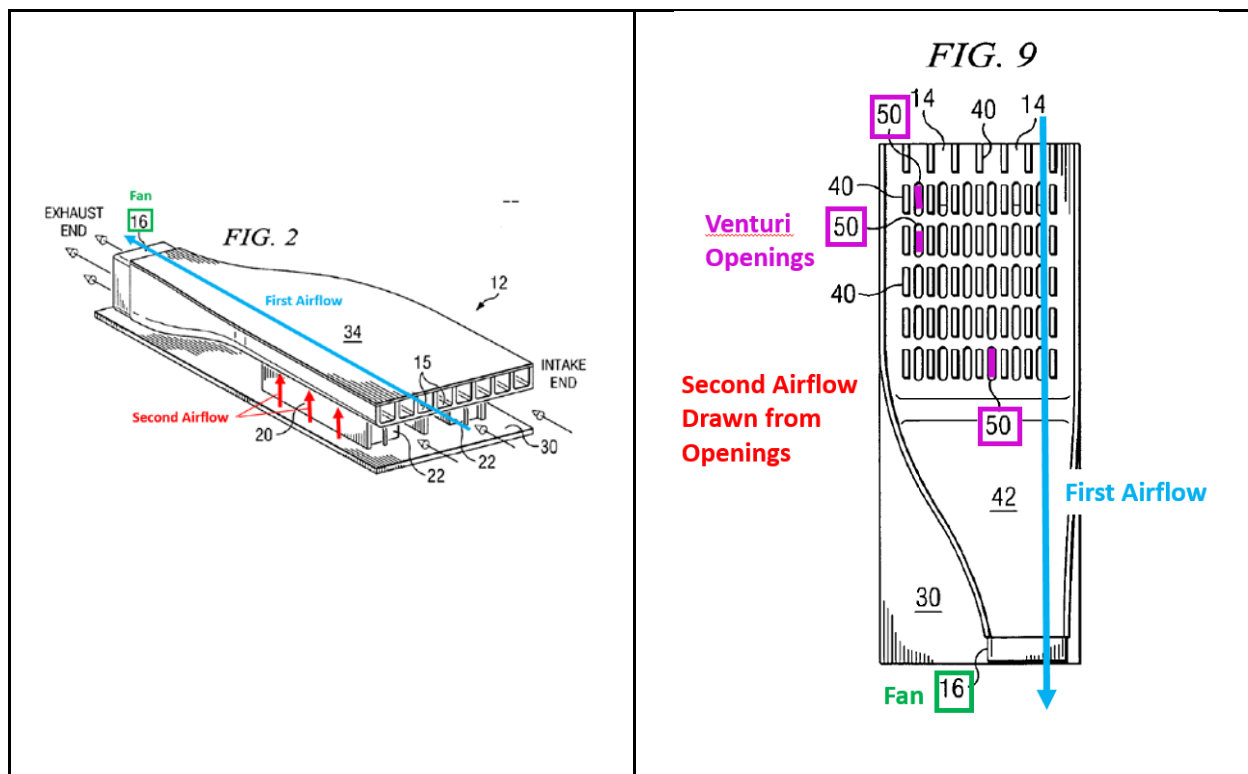
With reference to FIG. 2, Sterner explains this well-known phenomenon and how it is used in its cooling device for electronics. EX-1004 3:10-33; EX-1003 ¶57. *See also* § VII.A.2 [1.3] below. A POSA understood from Sterner that air within the first volume is forced to increase its velocity as it leaves the intake manifold 130 and is coupled with first coupling 134 into restriction chamber 150. As the air velocity increases, its pressure must decrease to conserve the energy of air mass moving through the air duct 15 according to the principle of conservation of energy and Bernoulli's principle. When the velocity increases in the restriction chamber 150, the air pressure against the sidewalls of the air duct 15 in restriction chamber 150 reduces. This reduction in pressure as the air velocity increases is known as the Bernoulli principle, which is another form of the principle of

conservation of energy or the simple form of the first law of thermodynamics. EX-1004 3:10-24. Sterner also explains that:

The restriction chamber 150 further has an opening or optionally a flared opening 140 on at least one sidewall to create a venturi vent 120. This venturi vent 120 then allows air outside of the air duct 15 to enter the opening thus allowing air outside of air duct 15 to mix with the air entering the intake manifold 130.

EX-1004 3:28-33; EX-1003 ¶57.

Further by way of example, Lord also used a fan-driven Venturi effect to draw an airflow in a forced convection cooling system for electronic enclosures. Specifically, Lord discloses an electronics plenum wherein “[a]ir communicating through the passageways defined by the fins removes heat from the fins, and also creates a venturi effect to remove heat from within a housing via the openings to further cool the portable electronic device.” EX-1007 Abstract; EX-1003 ¶58.



EX-1007 FIGs. 2, 9; EX-1003 ¶58.

Lord explains that:

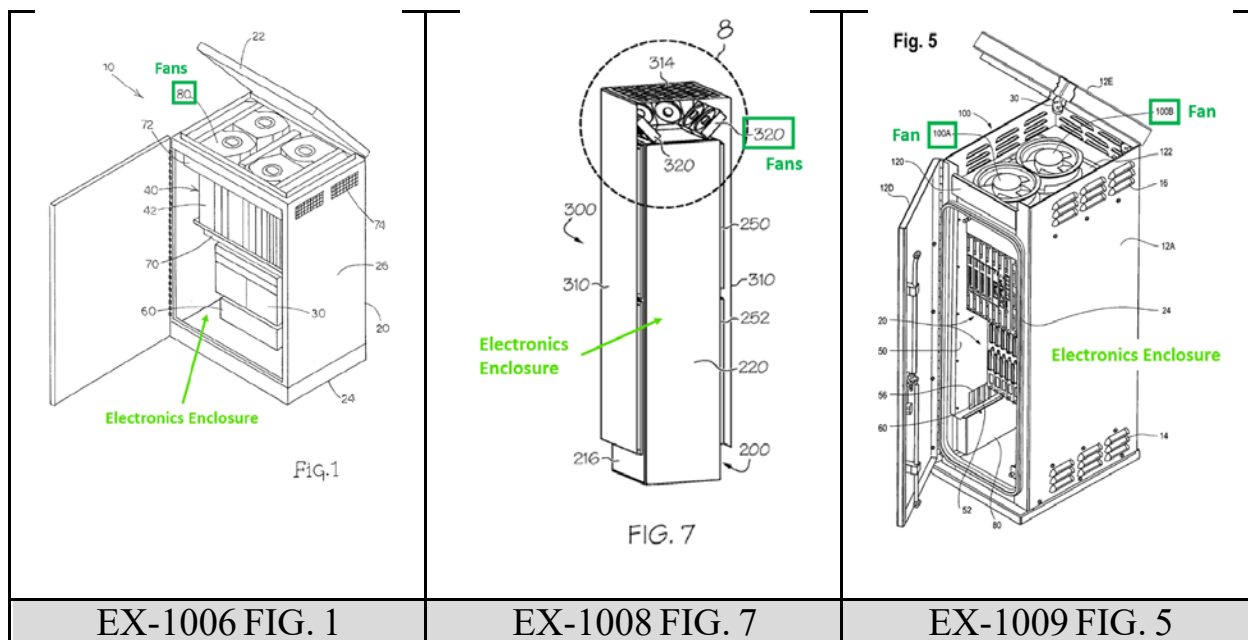
Openings 50 extend through the generally planar intake end of unitary base 38, each opening into the cavity 26 of device 10 proximate the heat generating components 22, as well as other electrical components 28 shown in FIG. 1. Advantageously, as air flows across each of these openings 50, a venturi effect is created, which venturi effect draws the heating [sic] air from within cavity 26 into the passageways 14 for exhausting via fan 16.

EX-1007 3:53-63; EX-1003 ¶59.

2. Forced Convection Cooling With Fan/Shroud Above Enclosure

In forced convection cooling systems for electronics enclosures, it was well-known to position one or more fans and the associated fan shrouds above the

enclosure such that air is drawn in at the bottom of the heat sink(s) and exhausted at the top. For example, each of Jones (EX-1006), Fischer (EX-1008), and Morrell (EX-1009) disclose such a fan/shroud arrangement:



A POSA understood that it was common to put a fan above a heat sink since warm air naturally rises and thus exposing the warm air to the suction side of a fan facilitates the amount of airflow being drawn from the heatsink and exhausted by the fan. EX-1003 ¶61.

VI. IDENTIFICATION OF CHALLENGES

A. Challenged Claims

Claims 1-5 and 14-20 of the '521 Patent are challenged in this Petition.

B. Statutory Grounds for Challenges

The Challenges are set forth in detail below and summarized as follows:

Ground	Claims	Basis	Reference
1	1, 3-5, 14-16	§ 103	Sterner in view of the knowledge of a POSA
2	1-2, 4-5, 14-17	§ 103	Aakalu in view of the knowledge of a POSA
3	3, 18-20	§ 103	Aakalu, alone, or in further view of Jones

Ground 1: Claims 1, 3-5, and 14-16 are unpatentable as being obvious over Sterner in view of the knowledge of a POSA.

Sterner

Sterner issued on Apr. 18, 2006 from an application filed on Jun. 11, 2002 (10/170,095). Sterner published on Dec. 2, 2002 (US 2002/0179286). Sterner qualifies as prior art at least under §102(b). *See also* § VIII.A.

Ground 2: Claims 1, 2, 4-5, 14-17 are unpatentable as obvious over Aakalu in view of the knowledge of a POSA.

Aakalu

Aakalu issued on Apr. 13, 1999 from an application filed on Mar. 28, 1997 (08/828,445). Aakalu qualifies as prior art at least under § 102(b). Aakalu formed the basis of an obviousness rejection during prosecution of Claims 14-20 and was overcome by amendment. *See also* § VIII.A.

Ground 3: Claims 3, 18-20 are unpatentable as obvious over Aakalu in further view of Jones.

Jones

U.S. Patent No. 6,104,003 (“Jones”) issued on Aug. 15, 2000 from an application filed on Oct. 7, 1999 (09/414,395), as a divisional of an application filed on Oct. 9, 1998 (09/169,362). Jones qualifies as prior art at least under § 102(b). Jones was not cited or applied by the Office during prosecution of the Challenged Claims.

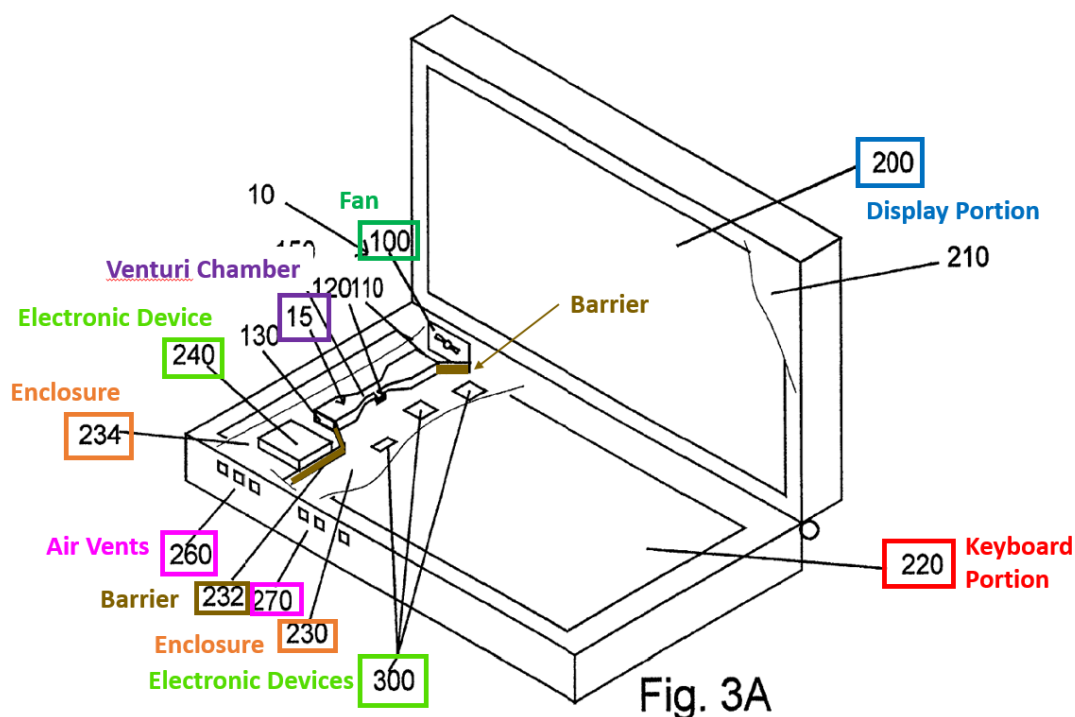
VII. IDENTIFICATION OF HOW THE CHALLENGED CLAIMS ARE UNPATENTABLE

A. Challenge 1: Claims 1, 3-5, 14-16 are obvious over Sterner alone

1. Sterner

Sterner is titled “Apparatus to Enhance Cooling of Electronic Device” and, like the ’521 Patent, is directed to a method for cooling electronic devices using a fan-driven Venturi effect to draw air through a heatsink, and a system implementing the cooling method. EX-1004 Title, Abstract. Specifically, Sterner identifies the field of invention as “a heat transfer system ... using a venturi to create separate air flows in an electronic device to cool components.” EX-1004 1:10-12; EX-1003 ¶65.

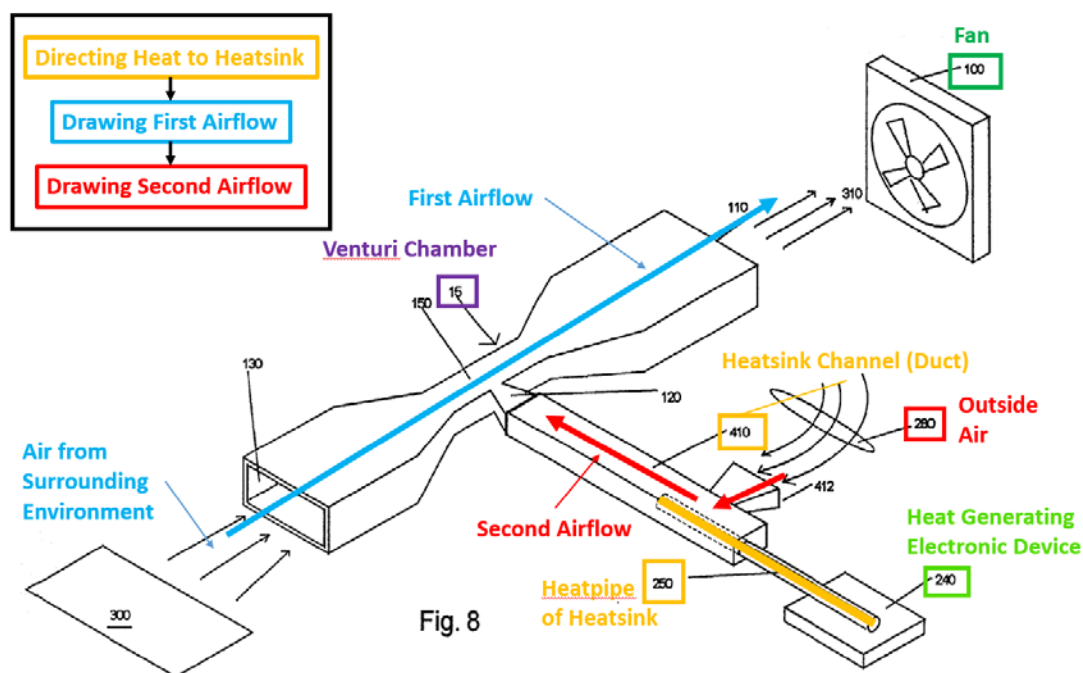
FIG. 3A as illustrates an embodiment.



EX-1004 FIG. 3; EX-1003 ¶66.

Sterner explains that electronic device 10, such as a notebook computer, includes a keyboard portion 220 (red) and a display portion 200 (blue). The keyboard portion 220 includes barriers 232 (brown) forming isolated enclosures or cavities 234, 230 (orange) that house heat producing electronic devices 240, 300 (green) respectively. A cooling device comprising air-moving device 100 (dark green), such as a fan or blower, and air duct (venturi chamber) 15 (purple) is positioned in enclosure 234. Air is drawn into the enclosures 234, 230 (orange) through vents 260, 270 (pink) respectively to remove heat produced by components 240, 300 housed within the enclosures. EX-1004 3:45-4:7; EX-1003 ¶67.

FIG. 8 illustrates one embodiment of the arrangement and operation of components for removing heat generated by components 240, 300 within enclosures 230, 234 respectively.



EX-1004 FIG. 8; EX-1003 ¶68.

Sterner explains that heatpipe 250 (gold) is thermally coupled to heat producing component 240 (green). Heatpipe 250 (gold) is further coupled to second duct 410 (gold) forming a heatsink. Fan 100 (dark green) draws a first airflow (blue) through the air duct (venturi chamber) 15 (purple) by pulling an exhaust air flow 310 from exhaust manifold 310 to thereby create an airflow into intake manifold 130. A low pressure region is created by drawing air through the restriction chamber 150. The restriction chamber is coupled to second duct 410 (which is coupled to the condensing end of a heat pipe 250) through venturi vent

120. Second duct 410 has an opening 412 used to draw in outside air 280, which is air external from electronic device 10 (FIG. 3A). Thus, a second airflow (**red**) is drawn through the second duct 410 using a venturi effect created by drawing the first airflow (**blue**) through air duct (venturi chamber) 15 (**purple**) to remove heat from heatsink 250 (**gold**) using the outside air 280. EX-1004 5:14-30; EX-1003 ¶69.

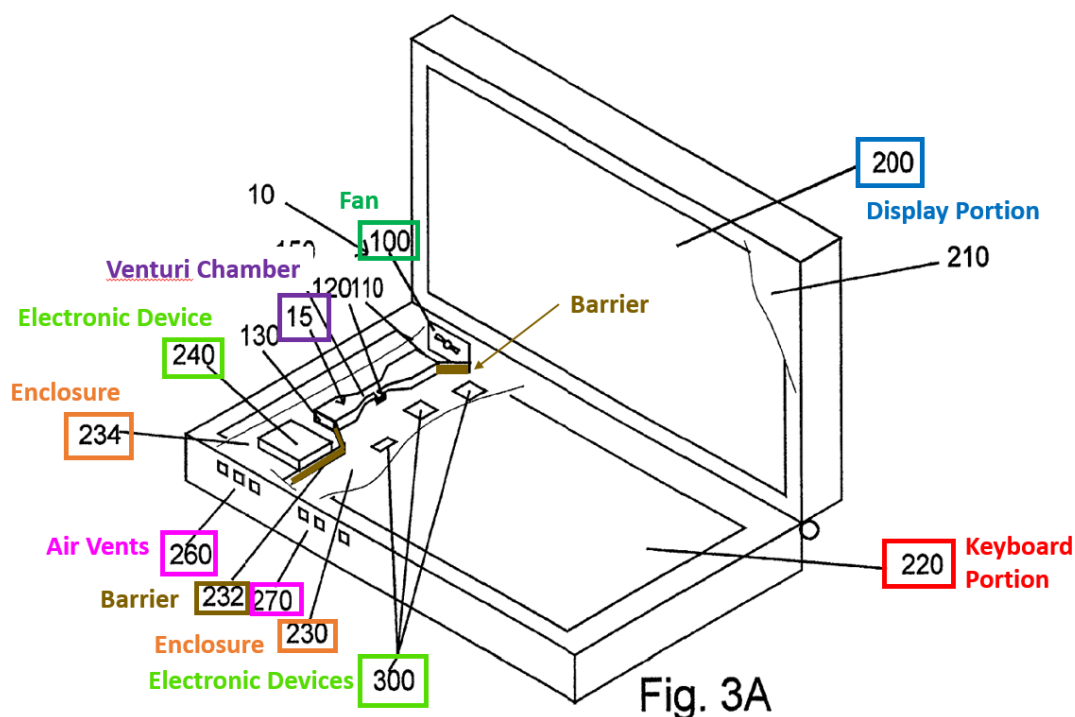
2. Detailed Application of Sterner to the Challenged Claims

Claim 1

[1.0] *A cooling unit for an enclosure housing electronics, the cooling unit comprising:*

To the extent the preamble is limiting, Sterner discloses element [1.0]. EX-1003 ¶70. Sterner is titled “Apparatus to Enhance Cooling of Electronic Device” and identifies the field of invention as “a heat transfer system ... using a venturi to create separate air flows in an electronic device to cool components.” EX-1004 Title, Abstract, 1:10-12; EX-1003 ¶70.

FIG. 3A illustrates an embodiment of the invention.

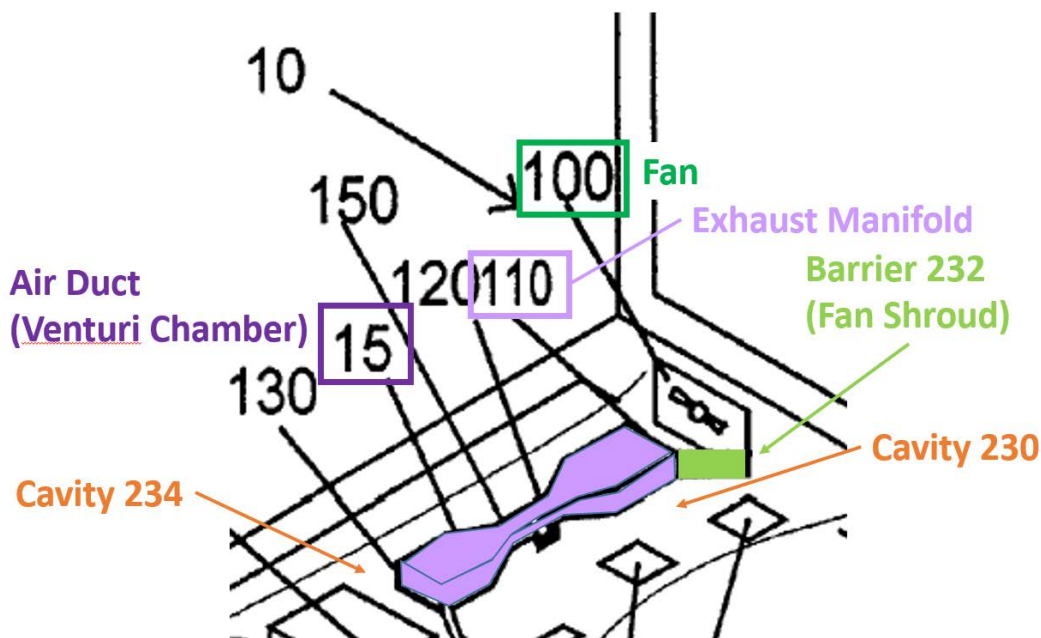


EX-1004 FIG. 3A; EX-1003 ¶71.

Sterner discloses device 10, such as a laptop computer, including barrier 232 (**brown**), fan 100 (**dark green**) and air duct 15 (**purple**) [collectively, the *cooling device*] that provides cooling for enclosures (cavities) 234, 230 (**orange**) [enclosure] housing electronic devices 240, 300 (**green**) [electronics]. A POSA understood that device 10 includes a cooling unit that provides cooling to an enclosure housing electronics. Thus, Sterner discloses element [1.0]. EX-1003 ¶72.

[1.1] *a fan shroud having at least one electrical fan; and*

Sterner discloses element [1.1]. EX-1003 ¶73. FIG. 10 is “an isometric drawing of an air duct useful for designing an exemplary embodiment of the



EX-1004 FIG. 3A (partial blow-up); EX-1003 ¶74.

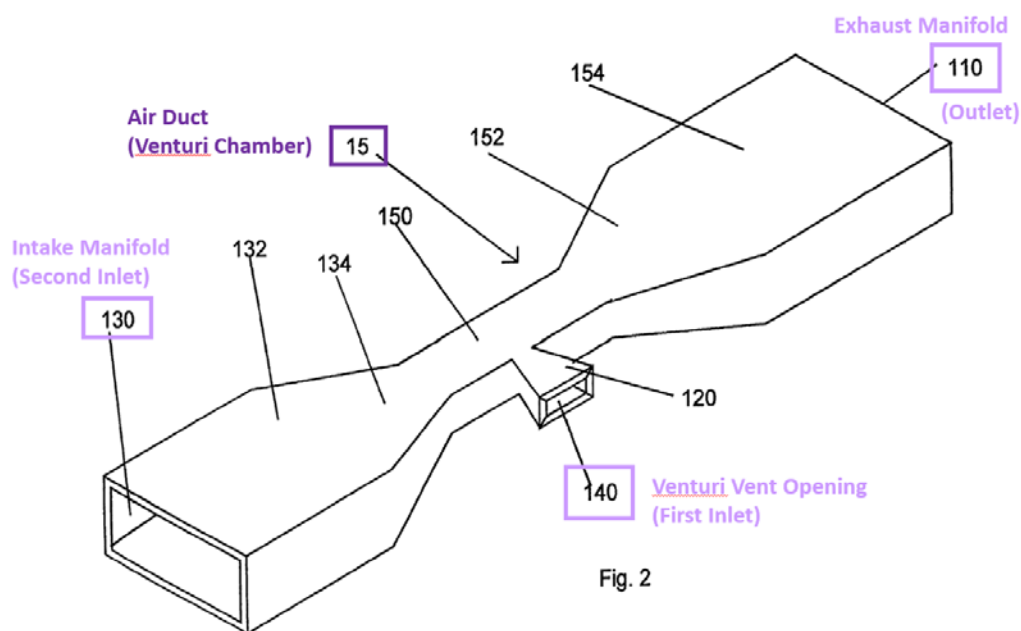
Sterner discloses that barrier 232 (green) isolates cavity 234 (orange) from cavity 230 (orange). EX-1004 3:57-59. Sterner further discloses that fan 100 (dark green) is positioned “proximal to the exhaust manifold 110 [lavender] of the air duct 15 (purple).” EX-1004 3:56-57. As shown, a portion of the barrier (green) extends between exhaust manifold 110 of air duct 15 (purple) to the intake of fan 100 (dark green) positioned proximal thereto, thereby providing isolation between the cavities such that airflow drawn from the exhaust manifold 110 is guided to the intake of fan 100 to be expelled from device 10. EX-1004 4:4-7; EX-1003 ¶75.

A POSA understood that, in addition to the portion of the device casing surrounding the fan, the portion of barrier 232 (green) extending between exhaust

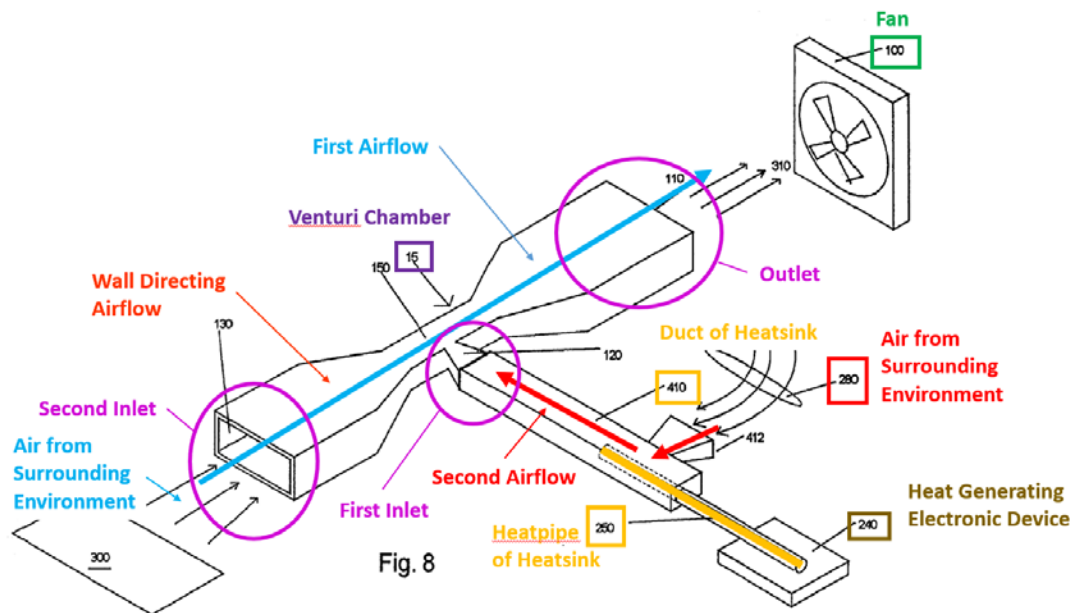
manifold 110 and the intake of fan 100 constitutes a fan shroud as recited in element [1.1]. Thus, Sterner discloses element [1.1]. EX-1003 ¶76.

[1.2] *a Venturi chamber having a first inlet for receiving a heated airflow from a heatsink, a second inlet for receiving an airflow from a surrounding environment, and an outlet coupled to the fan shroud, the fan drawing air from the Venturi chamber via the outlet when the fan is on;*

Sterner discloses element [1.2]. EX-1003 ¶77. FIG. 2 illustrates an air duct and FIG. 8 illustrates one embodiment of the arrangement and operation of components for removing heat generated by components 240, 300 within enclosures 230, 234 respectively.



EX-1004 FIG. 2; EX-1003 ¶77.



EX-1004 FIG. 8; EX-1003 ¶77

Sterner discloses that air duct 15 [*Venturi chamber*] comprises a venturi vent 120 having an opening 140 [*first inlet*] “that is preferably flared, and which helps to couple and operatively engage air external to the air duct 15 into the venturi vent 120.” EX-1004 3:10-13; EX-1003 ¶78.

Sterner explains that heatpipe 250 (gold) is thermally coupled to heat producing component 240 (green). Heatpipe 250 (gold) [*heatsink*] is further coupled to second duct 410 [*heatsink*] such that the second airflow (red) flowing through duct 410 is heated by heatpipe 250 [*heated airflow from the heatsink*]. As illustrated in FIG. 8, venturi vent 120 is coupled to duct 410 such that opening 140 receives the second airflow (red) that has been heated by heatpipe 250 [*heatsink*]. EX-1004 5:18-21. Thus, a POSA understood that opening 120 constitutes a *first*

inlet for receiving a heated airflow from a heat sink as recited in element [1.2].

EX-1003 ¶79.

Sterner further discloses that air duct 15 [*Venturi chamber*] comprises “an intake manifold 130 in which air is drawn into the air duct 15.” EX-1004 3:13-14.

As illustrated in FIG. 3A above, the airflow received into the intake manifold 130 of the air duct 15 is drawn from the surrounding environment through vents 260.

EX-1003 ¶80.

If PO argues that the air drawn into intake manifold 130 is not “drawn from the surrounding environment” because it passes over component 300, Sterner discloses that optionally air can be drawn directly from outside the device rather than drawing air over component 300 in order to cool the exhaust air. EX-1004 4:20-26. A POSA understood that this optional embodiment applies to the embodiment of FIG. 8 as well as the embodiment of FIG. 4. EX-1003 ¶81.

Thus a POSA understood that intake manifold 130 constitutes *a second inlet for receiving an airflow from a surrounding environment* as recited in element [1.2]. EX-1003 ¶82.

Sterner discloses that air duct 15 [*Venturi chamber*] comprises exhaust manifold 110 [*outlet*] where air exits the air duct. EX-1004 3:33-35. As set forth above with respect to element [1.1] and with reference to the partial blow-up of FIG. 3A, exhaust manifold 110 [*outlet*] is coupled to barrier 232 [*fan shroud*] such

that fan 100 [*fan*] draws air from air duct 15 [*Venturi chamber*] via the exhaust manifold 110 [*outlet*]. Thus, a POSA understood that exhaust manifold 110 constitutes *an outlet coupled to the fan shroud, the fan drawing air from the Venturi chamber via the outlet when the fan is on* as recited in element [1.2]. EX-1003 ¶83.

Hence, Sterner discloses element [1.2].

[1.3] wherein the Venturi chamber comprises a wall for directing the airflow air from the surrounding environment in from the second inlet and across the heated airflow from the heatsink in a manner to as to draw the heated airflow through the heatsink using a Venturi effect, when the fan is on.

Sterner discloses element [1.3]. EX-1003 ¶85. Sterner discloses that air duct 15 (**purple**) [*Venturi chamber*] comprises one or more walls (**red-orange**) for directing a first airflow (**blue**) from the surrounding environment in from the intake manifold 130 (**lavender**) [*second inlet*] past a venturi vent 120 in a manner as to draw air through the venturi vent 120 using a Venturi effect when fan 100 is operating. Specifically, Sterner discloses:

FIG. 2 illustrates an air duct 15 [*Venturi chamber*] that comprises a venturi vent 120. The venturi vent 120 has an opening 140, that is preferably flared, and which helps to couple and operatively engage air external to the air duct 15 into the venturi vent 120.

EX-1004 3:10-14; EX-1003 ¶86

A POSA understood from Sterner that air within the first volume is forced to increase its velocity as it leaves the intake manifold 130 and is coupled with first coupling 134 into restriction chamber 150. As the air velocity increases, its pressure must decrease to conserve the energy of air mass moving through the air duct 15 according to the principle of conservation of energy and Bernoulli's principle. When the velocity increases in the restriction chamber 150, the air pressure against the sidewalls of the air duct 15 in restriction chamber 150 reduces. This reduction in pressure as the air velocity increases is known as the Bernoulli principle, which is another form of the principle of conservation of energy or the simple form of the first law of thermodynamics. EX-1004 3:15-24; EX-1003 ¶87.

Sterner further states that:

The restriction chamber 150 further has an opening or optionally a flared opening 140 on at least one sidewall to create a venturi vent 120. This venturi vent 120 then allows air outside of the air duct 15 to enter the opening thus allowing air outside of air duct 15 to mix with the air entering the intake manifold 130. This mixed air is operatively engaged by being coupled through a second coupling 152 to an exhaust manifold 110 where it exits air duct 15.

EX-1004 3:25-35; EX-1003 ¶88.

Sterner further discloses that venturi vent 120 is coupled to duct 410 such that the second airflow (**red**) that has been heated by heatpipe 250 (**gold**) [*heated airflow through the heatsink*] is drawn into the venturi vent 120 using a venturi

effect caused by the first airflow (blue) when fan 100 (dark green) is operating.

EX-1003 ¶89.

Thus, a POSA understood that each of the one or more walls forming the air duct 15 constitute *a wall for directing the airflow air from the surrounding environment in from the second inlet and across the heated airflow from the heatsink in a manner to as to draw the heated airflow through the heatsink using a Venturi effect, when the fan is on* as recited in element [1.3]. EX-1003 ¶90.

Hence, a POSA understood that Sterner discloses element [1.3].

Claim 3

The cooling unit of claim 1, wherein the at least one electrical fan includes a primary fan and a backup fan that becomes operational upon a failure of the primary fan.

It was obvious to a POSA to modify Sterner to include the additional limitations recited in Claim 3. EX-1003 ¶92. It was well-known in the art of cooling enclosures housing electrical devices to include a back-up fan that becomes operational upon a failure of the primary fan. *See* EX-1006 4:46-51; EX-1003 ¶92. Moreover, the '521 Patent does not ascribe any point of patentability to the use of a second fan. To the contrary, the '521 Patent describes that a POSA “would appreciate that there are a number of methods to detect when the primary fan 260 has failed” to explain the addition of a backup fan. EX-1001 4:16-25; EX-1003 ¶92.

A POSA was motivated to include a backup fan to provide redundancy and prevent damage to the electronics in the event of a failure of the primary fan. The fan in a forced convection cooling system is a critical component, and a POSA understood the desirability of providing redundancy for critical components. Moreover, it was within the knowledge and skill of a POSA to design the cooling system with appropriately sized fans to provide sufficient cooling using primary or backup fans such that a POSA understood that implementing redundancy would be successful. EX-1003 ¶93.

Thus, it was obvious to a POSA to modify the teachings of Sterner to include one or more backup fans for redundancy as was well-known by a POSA. Hence, Claim 3 is obvious over Sterner. EX-1003 ¶94.

Claim 4

The cooling unit of claim 1, wherein the Venturi chamber first inlet encircles one or more convective openings of the heatsink.

Sterner discloses Claim 4. EX-1003 ¶95. As set forth for element [1.2], air duct 15 (**purple**) [*Venturi chamber*] comprises a venturi vent 120 having an opening 140 (**lavender**) [*Venturi chamber first inlet*] “that is preferably flared, and which helps to couple and operatively engage air external to the air duct 15 into the venturi vent 120.” EX-1004 3:10-13. Also, as set forth for element [1.2], venturi vent 120 is coupled and operatively engaged with duct 410 [*convective opening of the heatsink*] to receive second airflow (**red**) from duct 410 into venturi vent 120

through opening 140 [*Venturi chamber first inlet*]. A POSA understood that in order for venturi vent 120 to be coupled and operatively connected to duct 410, that opening 140 [*Venturi vent first inlet*] encircles the opening of duct 410 [*encircles one or more convective openings of the heatsink*]. EX-1003 ¶95.

Further, as set forth for element [1.2], Sterner discloses that duct 410 is thermally coupled to heatpipe 250 (gold) such that second airflow (red) flowing through duct 410 receives heat from heatpipe 250. Thus, a POSA understood that the opening of duct 410 constitutes *one or more convective openings of the heatsink* as recited in Claim 4. EX-1003 ¶96.

Hence, Sterner discloses Claim 4. EX-1003 ¶97.

Claim 5

The cooling unit of claim 1, wherein the airflow from the surrounding environment is cooler than the heated airflow.

Sterner discloses the additional limitations recited in Claim 5. EX-1003 ¶ 98. As set forth for element [1.2], Sterner discloses *a first inlet for receiving a heated airflow from a heatsink, and a second inlet for receiving an airflow from a surrounding environment*. Sterner discloses that the second airflow (red) [*heated airflow*] is drawn into duct 410 through opening 412 from “outside air 280, which is air external from electronic device 10.” EX-1004 5:23-25. A POSA understood that outside air 280 is drawn from the same surrounding environment and thus would be the same temperature as the air drawn into intake manifold 130 (the first

airflow (blue)) [*airflow from a surrounding environment*]. Thus, a POSA understood that the airflow from the surrounding environment is cooler than an airflow from the same surrounding environment that has been heated by heatpipe 250 (the second airflow (red)). EX-1003 ¶98.

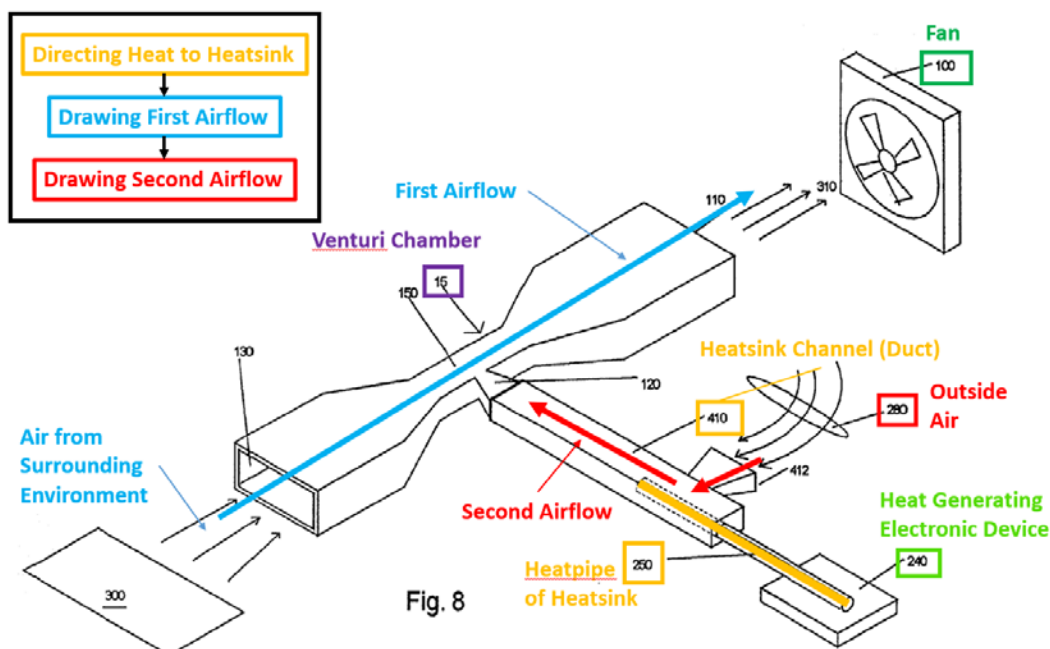
Hence, Sterner discloses Claim 5.

Claim 14

[14.0] *A method for cooling a sealed environment of an enclosure for housing electronics, the method comprising:*

To the extent the preamble is limiting, Sterner discloses element [14.0] for at least the reasons set forth for element [1.0]. EX-1003 ¶100.

Sterner provides FIG. 8 as illustrating one embodiment of the arrangement and operation of components for implementing a method for cooling a sealed environment of an enclosure housing electronics. Annotated FIG. 8 below illustrates how Sterner discloses the following steps recited in Claim 14.

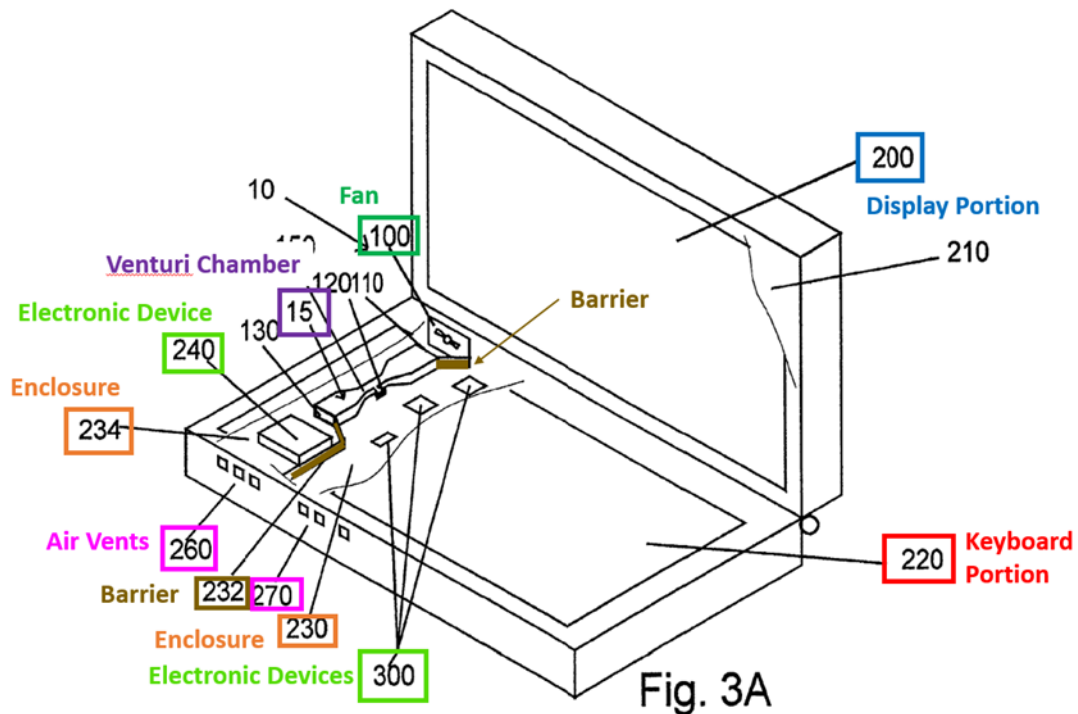


EX-1004 FIG. 8; EX-1003 ¶101

A POSA understood enclosure (cavity) 230 (**orange**) housing electronic device 240 (**green**) constitutes *a sealed environment of an enclosure for housing electronics* as recited in element [14.0]. EX-1003 ¶102.

[14.1] directing heat generated by one or more electronic devices housed within a sealed environment of an enclosure to a heatsink thermally coupled to an external environment;

Sterner discloses element [14.1]. Sterner discloses that keyboard portion 220 (**red**) includes barriers 232 (**brown**) forming isolated enclosures or cavities 234, 230 (**orange**) that house heat producing electronic devices 240, 300 (**green**) respectively. EX-1003 ¶103.



EX-1004 FIG. 3; EX-1003 ¶¶66, 103.

Sterner provides FIG. 8 as illustrating one embodiment of the arrangement and operation of components for removing heat generated by components 240, 300 within enclosures 230, 234 respectively. EX-1003 ¶104.

As set forth for element [1.2], Sterner discloses that heat producing electronic device 240 (**green**) [*electronics*] is housed in cavity 230 (shown in FIG. 3A) and “is preferably separated from system components 300 by a cavity or enclosure (not shown [in FIG. 8])” and that heat producing electronic device 240 is thermally coupled to heatpipe 250 (**gold**) which is thermally coupled to duct 410 [*directing heat generated by one or more electronic devices housed within a sealed environment of an enclosure to a heatsink*]. EX-1004 5:20-28. During operation,

the second airflow (**red**) is drawn into duct 240 through opening 412 from outside air 280, drawn into air duct 15 (**purple**) through venturi vent 120, and discharged from device 10 to the external environment by fan 100 (**dark green**) as part of exhaust air flow 380. Thus, a POSA understood that heatpipe 250 and duct 410 constitute *a heatsink thermally coupled to an external environment* as recited in element [6.1]. EX-1003 ¶105. Hence, Sterner discloses element [14.1].

[14.2] *drawing a first airflow across one or more convective openings of the heatsink, wherein the first airflow does not flow into the one or more convective openings of the heatsink;*

Sterner discloses element [14.2] for at least the reasons set forth for element [1.3]. Sterner discloses a venturi chamber comprising *a wall for directing the airflow air from the surrounding environment in from the second inlet and across the heated airflow from the heatsink in a manner to as to draw the heated airflow through the heatsink using a Venturi effect, when the fan is on* as recited in element [1.3]. Sterner draws a first airflow (**blue**) through air duct 15 (**purple**) such that the first airflow flows through restriction chamber 15 and across venturi vent 120 that is coupled to an opening of duct 410 [*one or more convective openings of the heatsink*], thereby drawing the second airflow (**red**) into venturi vent 120 using a venturi effect. EX-1004 3:10-44, 5:18-20; EX-1003 ¶106. A POSA understood from the description of Sterner and the well-known behavior of venturis, that the first airflow (**blue**) does not flow into duct 410 [*one or more convective openings*

of the heatsink], but rather, the first airflow draws the second airflow (red) from duct 410 and into venturi vent 120. EX-1003 ¶106.

Thus, a POSA understood that the operation of the embodiment described by Sterner with reference to FIG. 8 constitutes *drawing a first airflow across one or more convective openings of the heatsink, wherein the first airflow does not flow into the one or more convective openings of the heatsink* as recited in element [14.2]. EX-1003 ¶107. Hence, Sterner discloses element [14.2].

[14.3] *drawing a second airflow of heated air from the one or more convective openings using a Venturi effect created by drawing the first airflow.*

Sterner discloses element [14.3] for at least the same reasons as set forth for element [14.2]. The first airflow (blue) [*first airflow*] flowing through air duct 15 draws the second airflow (red) [*second airflow*] from duct 410 (gold) [*one or more convective openings of the heatsink*] using a venturi effect. EX-1004 3:10-44, 5:18-20. A POSA understood that that the operation of the embodiment described by Sterner with reference to FIG. 8 constitutes *drawing a second airflow of heated air from the one or more convective openings using a Venturi effect created by drawing the first airflow* as recited in element [14.3]. EX-1003 ¶108. Thus, Sterner discloses element [14.3]. EX-1003 ¶108.

Claim 15

[15.0] *The method of claim 14*

[15.1] *wherein drawing the first airflow further comprises drawing the first airflow into a Venturi chamber;*

Sterner discloses the additional limitations recited in element [15.1] for at least the reasons set forth above with respect to elements [1.2], [1.3], and [14.2]. EX-1003 ¶109.

[15.2] *wherein drawing the second airflow further comprises drawing the second airflow into the Venturi chamber;*

Sterner discloses the additional limitations recited in element [15.2] for at least the reasons set forth for elements [1.2], [1.3], and [14.3]. EX-1003 ¶110.

[15.3] *the method further comprising operating a fan to pull the first airflow and the second airflow out of the Venturi chamber.*

Sterner discloses the additional limitations recited in element [15.3] for at least the reasons set forth for elements [1.2], [14.2] and [14.3]. EX-1003 ¶111.

Claim 16

The method of claim 14, further comprising operating a fan to draw the first airflow and the second airflow.

Sterner discloses the additional limitations recited in Claim 16 for at least the reasons set forth for elements [1.2], [14.2] and [14.3]. EX-1003 ¶112.

B. Challenge 2: Claims 1, 2, 4-5, 14-17 are obvious over Aakalu alone

1. Aakalu

Aakalu is titled “Enclosures for Heat Producing Devices” and, like the ’521 Patent, is directed to a method for cooling electronic devices housed in an enclosure using a fan-driven Venturi effect to draw air upward through a heat sink, and a system implementing the cooling method. EX-1005 Title, 3:30-34; EX-1003 ¶113.

Aakalu explains that, as of the late 1990’s, “in the development of wireless communication networks, it is desirable to provide a number of small base stations, called microcells” and that “[o]ne implementation of such microcells involves the packaging of electronic components associated with the base stations into small outdoor enclosures” but that “most enclosures tend to trap heat which may be detrimental to the electronic components, particularly to integrated circuits and microprocessor chips.” EX-1005 1:12-20; EX-1003 ¶114. Aakalu further explains that “outdoor enclosures containing any electronic components are subject to two forms of heat: heat generated by the electronic components and solar heat” and that it was known to dissipate the component generated heat using heat sinks and convection, and to cover the enclosures with a solar shield to shelter the enclosure from solar heat. EX-1005 1:21-34; EX-1003 ¶114.

Aakalu then notes that “using the solar shields in combination with the heat sinks, in most cases, can significantly decrease the overall efficiency of the convection process. Accordingly, there exist a need for an enclosure with a cooling scheme for heat producing devices that shelters the enclosures from solar heat without significantly decreasing the efficiency of the convection process associated with heat sinks.” EX-1005 1:34-44; EX-1003 ¶115.

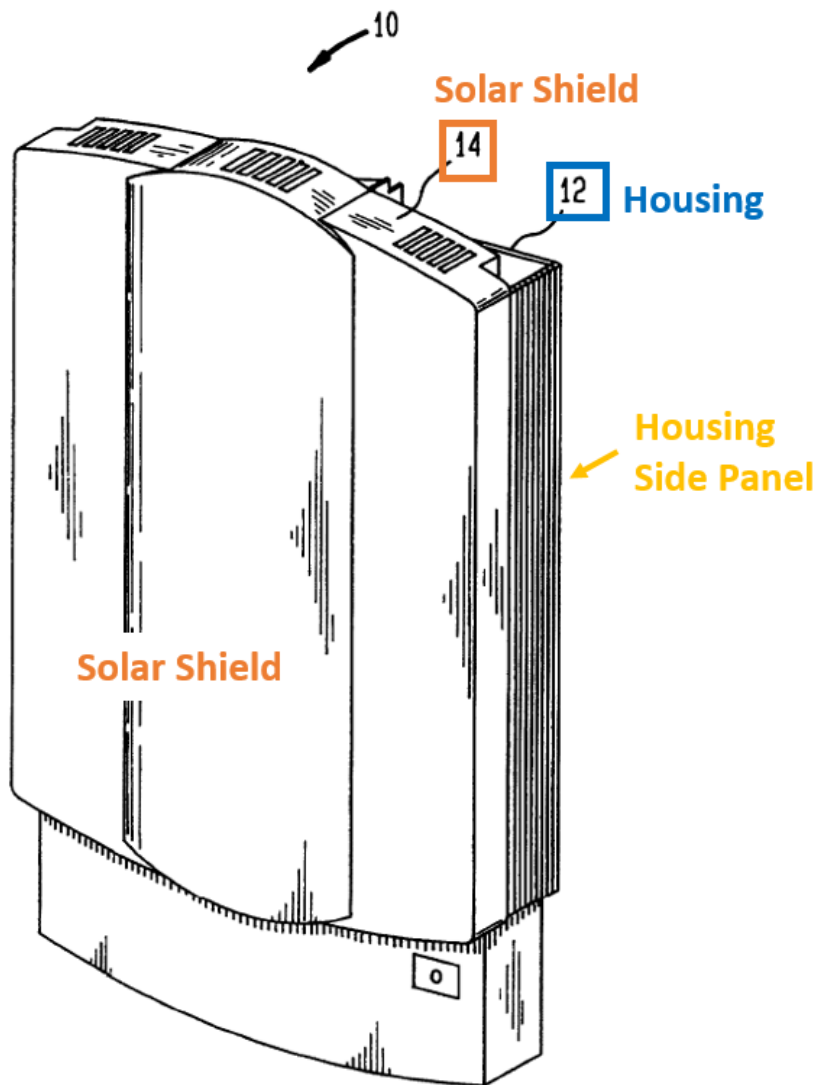
Aakalu summarizes its solution as “an enclosure cooling scheme for cooling heat producing devices, such as electronic components, contained within the enclosure” wherein, in an embodiment, “[t]he enclosure comprises a housing and a solar shield.” EX-1005 1:48-56; EX-1003 ¶116. Aakalu further describes the enclosure:

The housing includes a plurality of heat sinks for absorbing and dissipating heat generated by the devices. Each heat sink has an interior side to which the devices are mounted and an exterior side with a plurality of fins that form first and second channels. In one embodiment, the first channels are aligned longitudinally with the prevalent direction of airflow, and the second channels are aligned in a contrasting manner to the first channels to allow fresh air to be drawn into the first channels (through the second channels) during the convection process. Positioned over the heat sinks is the solar shield for sheltering the housing from solar heat. The solar shield includes ventilators which align with the first and second channels for allowing

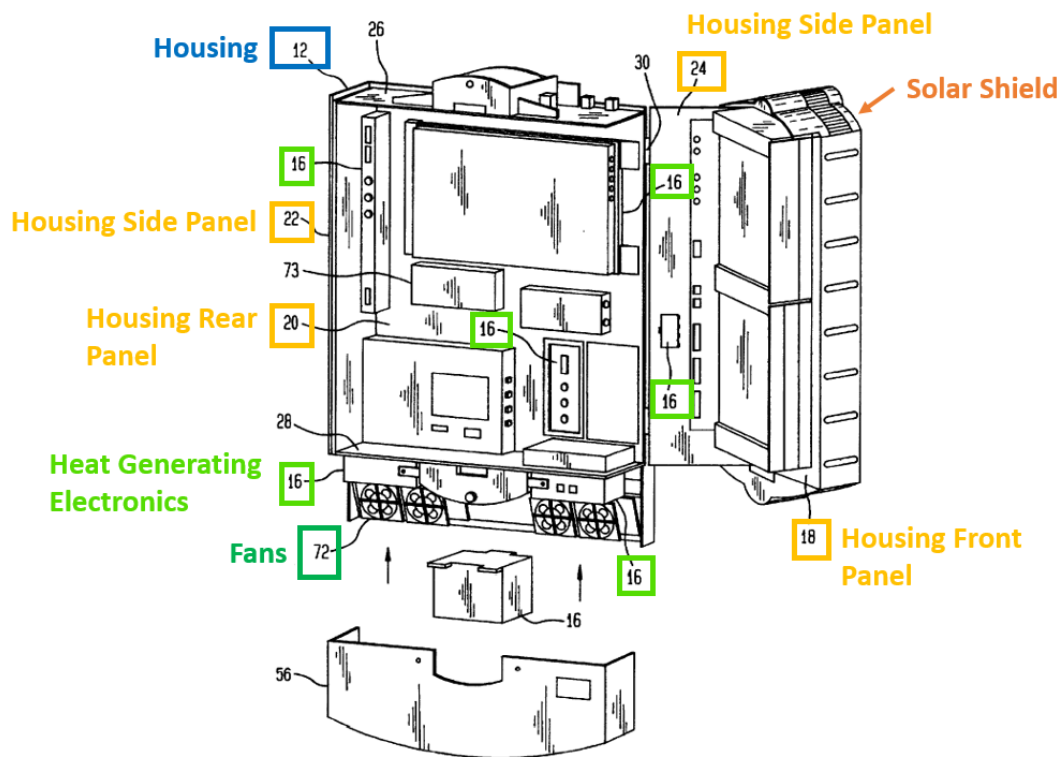
the passage of air into the heat sinks and heat absorbed by the heat sinks to be dissipated.

EX-1005 1:56-2:3; EX-1003 ¶116.

Aakalu provides FIGs. 1 and 2 depicting the enclosure in the closed (FIG. 1) and open (FIG. 2) positions.



EX-1005 FIG. 1; EX-1003 ¶117

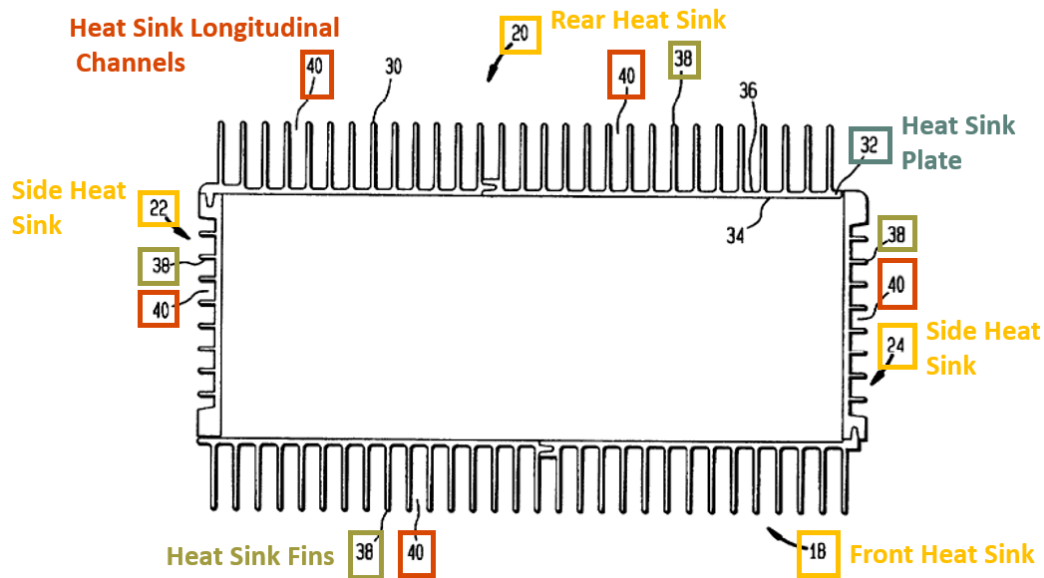


EX-1005 FIG. 2; EX-1003 ¶117

Aakalu explains that enclosure 10 (referred to as a microcell) comprises housing 12 (**blue**) and solar shield 14 (**orange**). A plurality of electronic components 16 (**green**) are mounted to the interior of housing 12. Housing 12 comprises front panel 18 (**gold**), rear panel 20 (**gold**), and two side panels 22, 24 (**gold**), each of which form heat sinks for absorbing and dissipating heat generated by electronic components 16 (**green**). EX-1005 2:59-3:9; EX-1003 ¶118.

Aakalu illustrates a top view of enclosure 10 with the solar shield removed in FIG. 5:

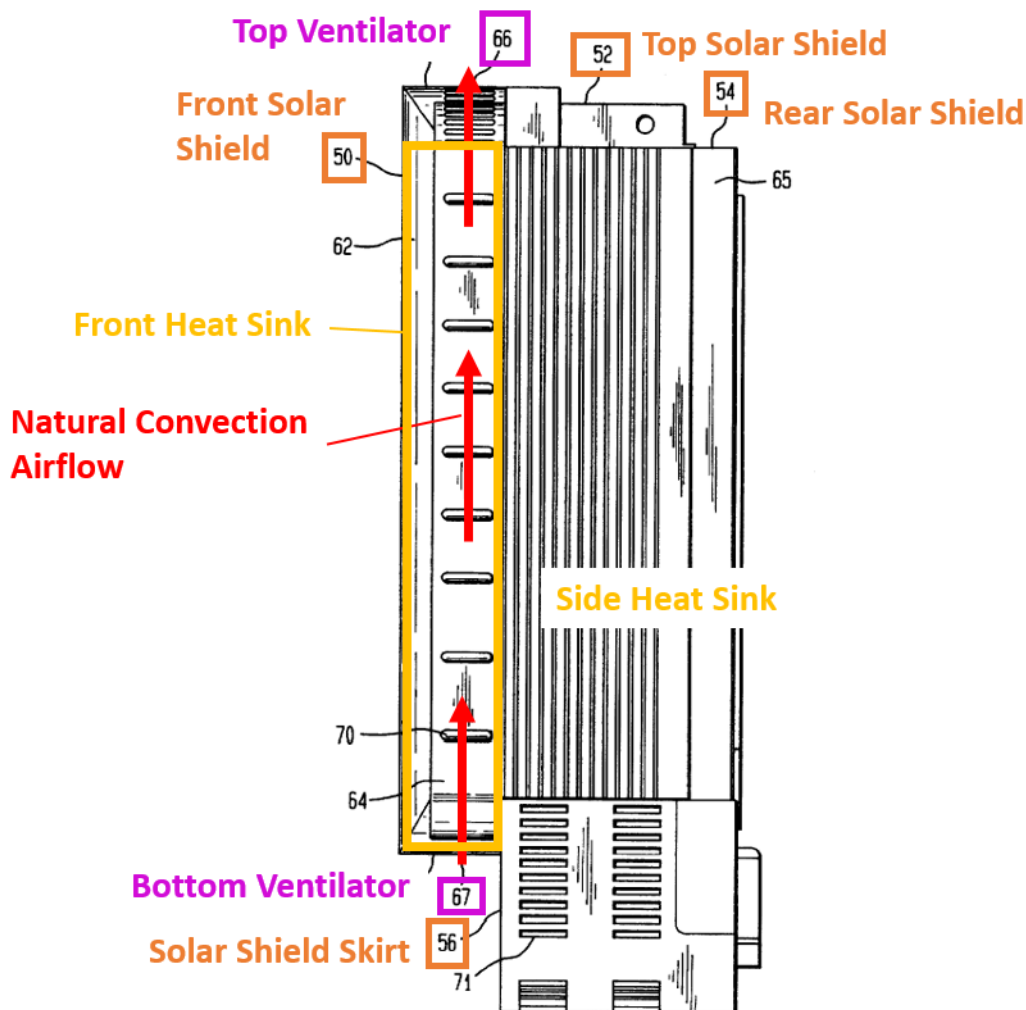
FIG. 5



EX-1005 FIG. 5; EX-1003 ¶119.

Aakalu explains that “[p]referably, the heat sinks [(gold)] are formed from a highly heat conductive material” and that each comprises “a heat sink plate 32 [(teal)] having an interior side 34 to which the base station electronic components 16 are mounted and an exterior side 36 having a plurality of fins 38 [(bronze)]” wherein “[t]he fins 38 project laterally outward from the exterior side 36 and form channels 40 [(red-orange)] (referred to herein as longitudinal channels) between through which cooling air may pass.” EX-1005 3:9-20; EX-1003 ¶120.

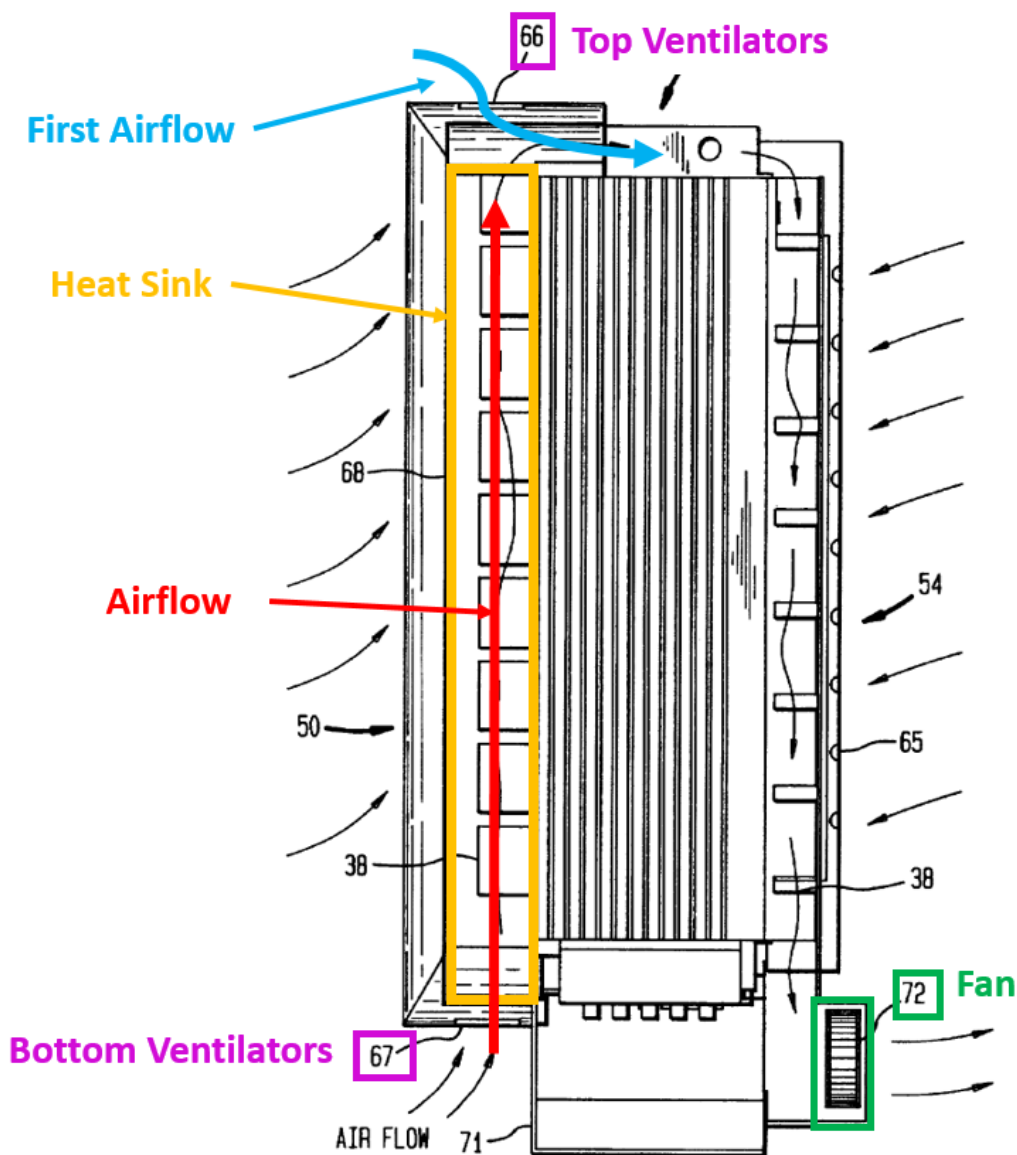
Aakalu further explains that “solar shield 14 [(orange)] (FIGs. 1, 2) shelters the microcell 10 from solar heat” and “is adapted to fit over the front, rear, top and bottom panels 18, 20, 26, 28 of the housing 12.” EX-1005 3:49-53; EX-1003 ¶121. FIG. 7 illustrates a side view of enclosure 10 with the solar shield installed.



EX-1005 FIG. 7; EX-1003 ¶121.

Solar shield 14 comprises front, top, rear, and skirt solar shields 50, 52, 54, 56 (**orange**). Front solar shield 50 top and bottom ventilators 66, 67 (**red-purple**) such as slots that align with the longitudinal channels 40 (**red-orange**) (FIG. 5) of the front heat sink (**gold**) to thereby allow airflow passage (**red**) upward through the heat sink due to natural convection. EX-1005 3:63-4; EX-1003 ¶122.

FIG. 10 depicts “a side cross-sectional view of microcell 10 illustrating the path of airflow through the microcell using forced convection” – i.e., by operating fans 72. EX-1005 4:56-58; EX-1003 ¶123.



EX-1005 Fig. 10; EX-1003 ¶123.

Aakalu explains that when fans 72 are operating during forced convection cooling of enclosure 10, “fresh air is drawn in through the top ventilators 66 and

mixed with the old air as it passes over the top panel 26 and enters the longitudinal channels of the rear panel” and that “the fans draw air in through the ventilators.” EX-1005 4:64-67, 6:59-60. The air drawn in through the top ventilators 66 (**red-purple**) is depicted as the first airflow (**blue**). EX-1003 ¶124. Air is also drawn in through the bottom ventilators 67 (**red-purple**) and “travels through the longitudinal channels dissipating heat absorbed by the heat sink (of the front panel)” as depicted by the second airflow (**red**). EX-1005 4:57-60; EX-1003 ¶124. Aakalu further explains that the amount of air drawn up through the front heat sink (**second (heated) airflow**) is determined by the amount of air drawn in through the top ventilators 66 (**first airflow**) during the forced convection cooling operation. EX-1005 5:4-9; EX-1003 ¶124.

A POSA understood that as the air is drawn in through the top ventilators (**first airflow**) flows into the constricted volume bounded by top panel 26 and top solar shield 52, the flow rate increases and the pressure decreases, and that this Venturi effect will increase the airflow upward through the front heatsink (**second (heated) airflow**). EX-1003 ¶125.

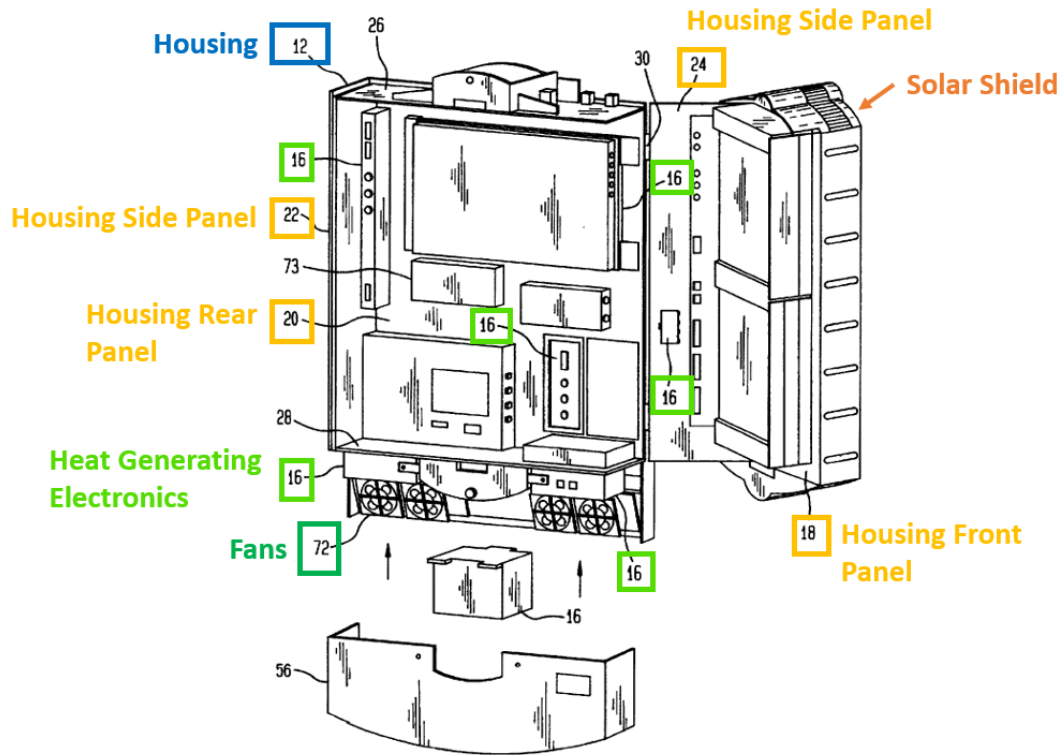
Aakalu also discloses that the cooling device may include a regulation device to automatically control the size of the ventilators to control the volume of air flowing through the microcell and hence control the temperature of the components housed within the microcell. EX-1005 5:21-29; EX-1003 ¶126.

2. Detailed Application of Aakalu to the Challenged Claims

Claim 1

[1.0] *A cooling unit for an enclosure housing electronics, the cooling unit comprising:*

To the extent the preamble is limiting, Aakalu discloses element [1.0]. EX-1003 ¶127. Aakalu is titled “Enclosures for Heat Producing Devices” and summarizes the disclosed invention as “an enclosure with a cooling scheme for cooling heat producing devices, such as electronic components, contained within the enclosure” and further states that “[t]he present invention is an enclosure with a scheme for convectively cooling heat producing devices, such as electronic components, housed within the enclosure.” EX-1005 1:48-50; 2:43-45; EX-1003 ¶127. Aakalu illustrates the enclosure in an open position in FIG. 2:



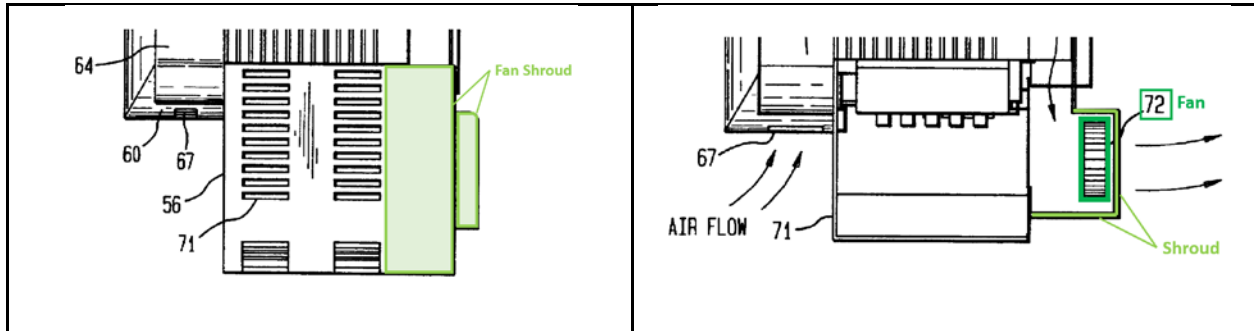
EX-1005 FIG. 2; EX-1003 ¶127

Aakalu explains that the enclosure 10 (microcell) comprises housing 12 (blue) and solar shield 14 (orange). A plurality of electronic components 16 (light green) are mounted to the interior of housing 12 [*an enclosure housing electronics*]. Housing 12 comprises front panel 18 (gold), rear panel 20 (gold), and two side panels 22, 24 (gold), each of which form heat sinks for absorbing and dissipating heat generated by electronic components 16 (light green). EX-1005 2:59-3:9; EX-1003 ¶128. Aakalu discloses that, in one mode of operation, “forced convection is used to dissipate the heat absorbed by the heat sink” and that “microcell 10 includes fans 72 [(green)] which facilitate the flow of air through the heat sinks” [*cooling unit for an enclosure*] EX-1005 3:30-34; EX-1003 ¶128.

Thus, Aakalu discloses element [1.0].

[1.1] *a fan shroud having at least one electrical fan; and*

Aakalu discloses element [1.1]. EX-1003 ¶130. Partial blow-ups of a side view (FIG. 7) and side cross-sectional view (FIG. 10) are shown below:

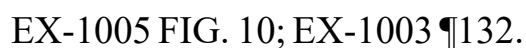


EX-1005 FIGs. 7, 10 (partial blow-ups); EX-1003 ¶130.

As illustrated, “microcell 10 includes fans 72 [(green)] [at least one electrical fan] which facilitate the flow of air through the heat sinks.” EX-1005 3:30-34. A POSA understood that the structure surrounding each fan 72 constitutes a fan shroud (green) [fan shroud]. Thus, Aakalu discloses element [1.1]. EX-1003 ¶131.

[1.2] *a Venturi chamber having a first inlet for receiving a heated airflow from a heatsink, a second inlet for receiving an airflow from a surrounding environment, and an outlet coupled to the fan shroud, the fan drawing air from the Venturi chamber via the outlet when the fan is on;*

Aakalu discloses element [1.2]. EX-1003 ¶132. Aakalu discloses that “forced convection is used to dissipate the heat absorbed by the heat sink” and that “microcell 10 includes fans 72 which facilitate the flow of air through the heat

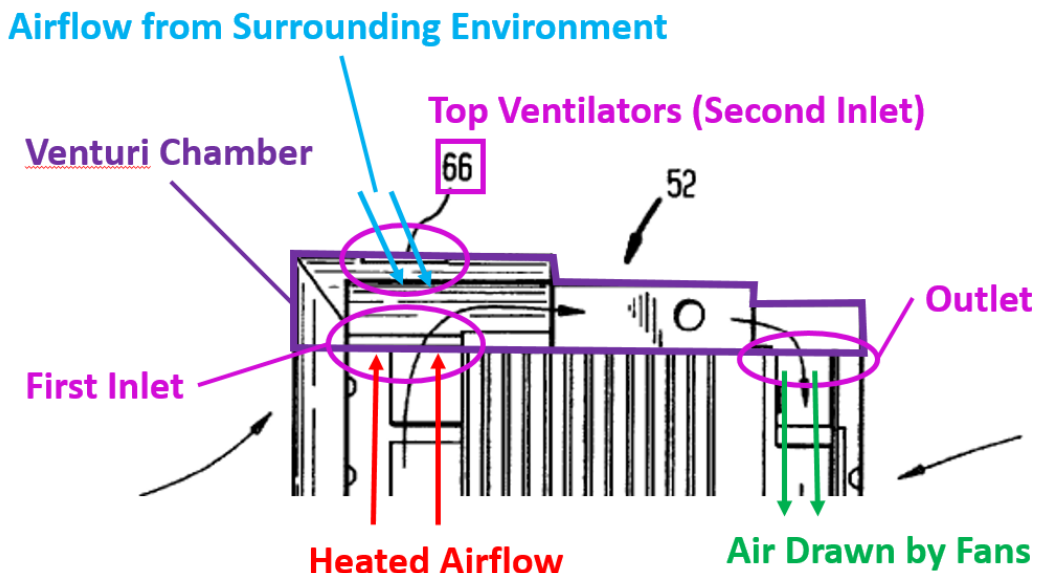


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enters the longitudinal channels of the rear panel.” EX-1005 4:64-67. A POSA understood that the air drawn in through the top ventilators 66 (red-purple) constitutes an *airflow from a surrounding environment* (blue) as recited in element [1.2]. EX-1003 ¶133.

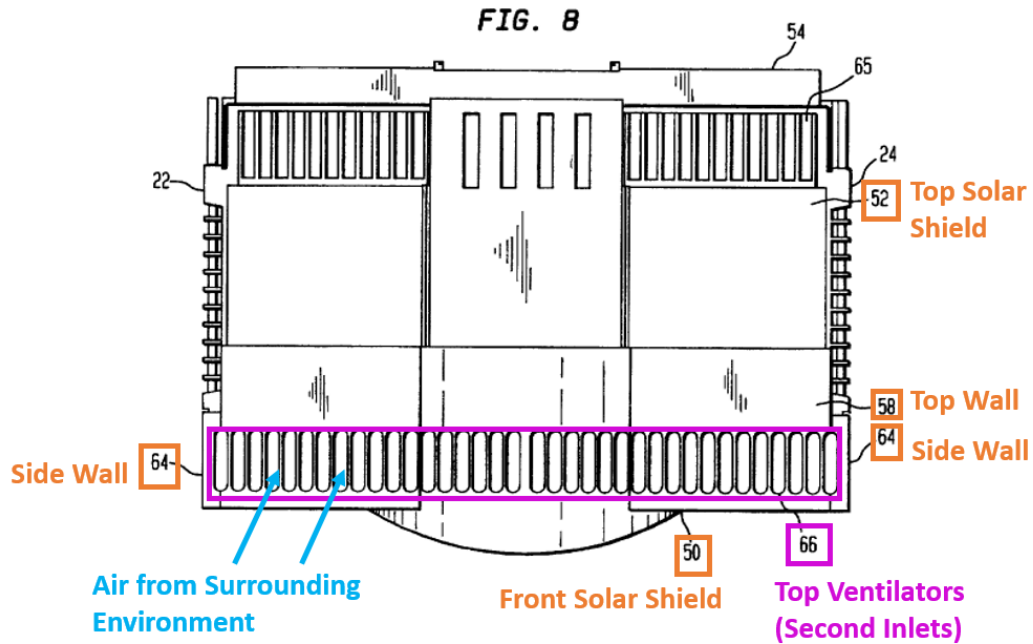
Air is also drawn in through the bottom ventilators 67 (red-purple) and “travels through the longitudinal channels dissipating heat absorbed by the heat sink (of the front panel).” EX-1005 4:57-60. A POSA understood that the airflow traveling through the heat sink (gold) constitutes a *heated airflow* (red) as recited in element [1.2]. EX-1003 ¶134.

A POSA further understood that the upper portions of the solar shields 50, 52 (orange) and top panel 26 of the enclosure form a Venturi chamber (purple) as shown in the partial blow up of FIG. 10 below:

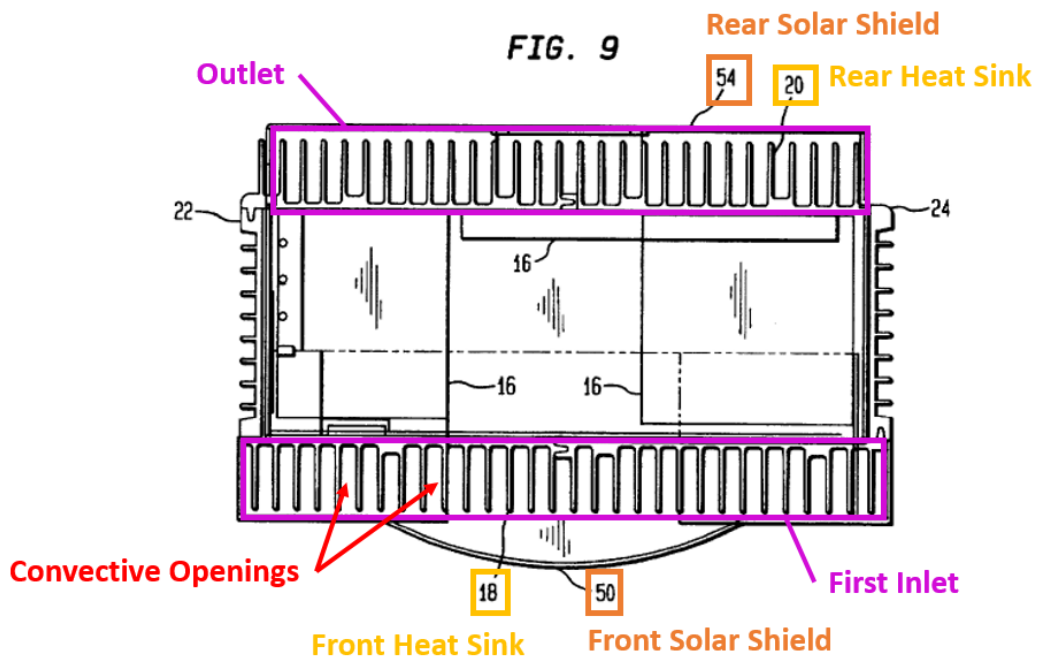


EX-1005 FIG. 10 (partial blow-up); EX-1003 ¶135.

FIGs. 8 and 9 depict a top and top cross-sectional view:



EX-1005 FIG. 8; EX-1003 ¶136.



EX-1005 FIG. 9; EX-1003 ¶136.

The Venturi chamber (**purple**) in the device of Aakalu includes a first inlet (**red-purple**) positioned adjacent the convective openings (**red**) at the top of the longitudinal channels of the front heat sink (**gold**) such that the heated airflow (**red**) flowing upward through the front heat sink is received into the Venturi chamber through the first inlet and flows over the top panel 26 [*a first inlet for receiving a heated airflow from a heat sink*]. EX-1005 4:57-67; EX-1003 ¶137.

The Venturi chamber also includes a plurality of top ventilators 66 (**red-purple**) forming an inlet where fresh air is drawn in from the surrounding environment (**blue**) [*a second inlet for receiving an airflow from a surrounding environment*]. EX-1005 4:64-5:10; EX-1003 ¶138.

Aakalu further discloses that air is drawn from the Venturi chamber by the operating fan(s) (**dark green**) through an outlet (**red-purple**) and downward through the longitudinal channels of the rear heat sink 20 to be exhausted by fan(s) 72 [*the fan drawing air from the Venturi chamber via the outlet when the fan is on*]. EX-1005 4:63-5:4; EX-1003 ¶139. A POSA understood that the outlet (**red-purple**) is coupled to the fan shroud (**light green**) by rear heat sink 20 and rear solar shield 54 [*outlet coupled to the fan shroud*]. EX-1003 ¶139.

As discussed in the State of the Art section, a POSA understood that as air is drawn in through the top ventilators 66 (**red-purple**) it is subject to a reduction in

volume formed in the restriction chamber that guides the air to the outlets thereby producing venturi effect that draws heated air into the chamber from the convective openings of the heat sink. Thus, Aakalu discloses element [1.2]. EX-1003 ¶140.

[1.3] wherein the Venturi chamber comprises a wall for directing the airflow air from the surrounding environment in from the second inlet and across the heated airflow from the heatsink in a manner to as to draw the heated airflow through the heatsink using a Venturi effect, when the fan is on.

Aakalu discloses element [1.3]. EX-1003 ¶141. The Venturi chamber (purple) includes at least side walls 64 (orange) and top wall 58 (orange) that direct the airflow (blue) [*airflow air from the surrounding environment*] in from the top ventilators 66 (red-purple) [*second inlet*] and across the convective openings containing the heated airflow (red) flowing from the front heat sink (gold) [*across the heated airflow from the heat sink*]. While Aakalu does not expressly use the term “Venturi effect” to describe the interaction between the airflow (blue) drawn in through ventilators 66 [*second inlet*] and the heated airflow (red), a POSA understood from Aakalu that the airflow (blue) is drawn across the convective openings (red) of the heat sink in a manner so as to draw the heated airflow through the heat sink using a Venturi effect. EX-1003 ¶141.

Aakalu explains that fan(s) 72 draw the airflow (blue) in through the ventilators 66, and that the amount of air drawn up through the front heat sink

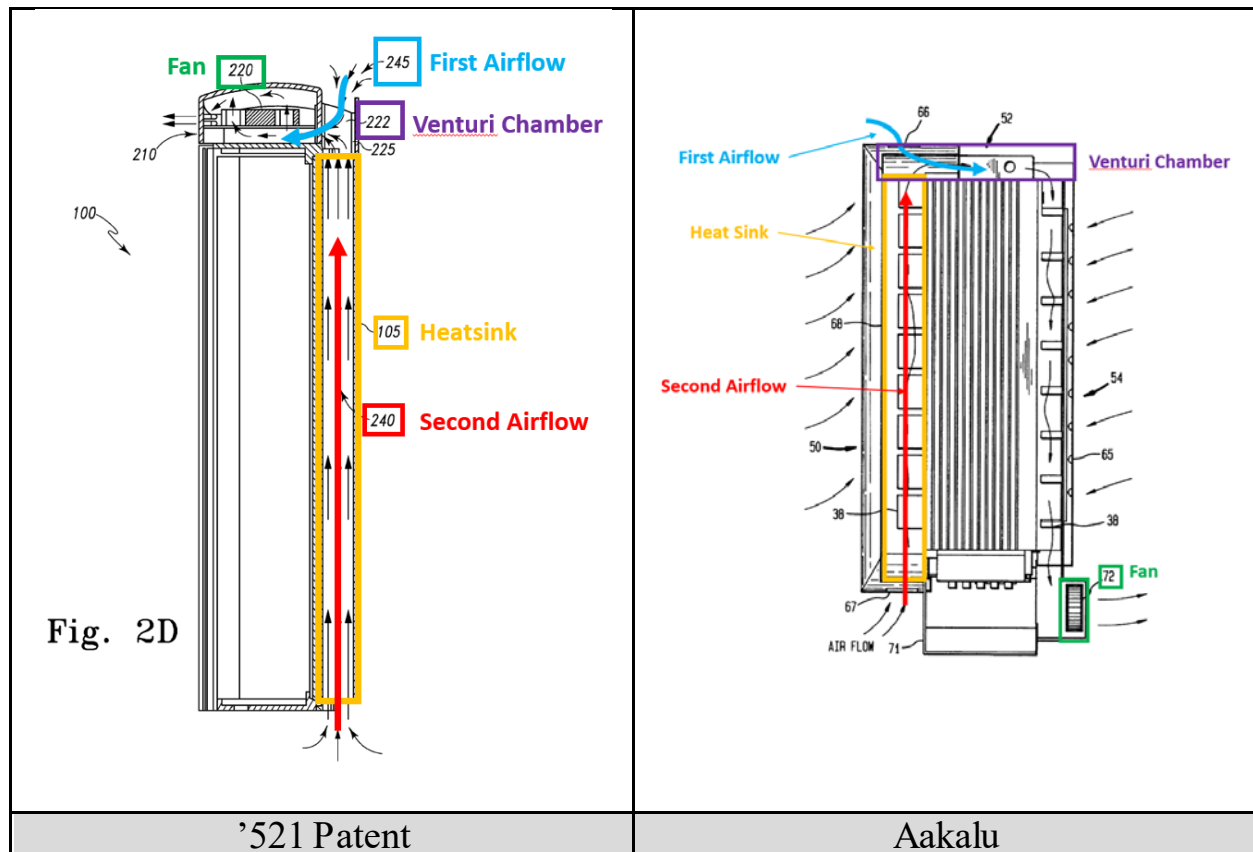
(**heated airflow**) is determined by the amount of air drawn in through the ventilators 66 (**first airflow**) during the forced convection cooling operation:

the top ventilators 66 also functions as a metering device for airflow during forced convection. The amount of fresh air drawn into the microcell during forced convection can be controlled by the size of the top ventilators 66 and the speed of the fans 72. In other words, the ratio of air drawn in through the front solar shield 50 is determined, in part, by the size of the slots 66.

EX-1005 5:4-9; EX-1003 ¶142.

A POSA understood that in order for the amount of airflow (**blue**) drawn in through ventilators 66 to “meter” the heated airflow (**red**) that the heated airflow is drawn through the heat sink using a Venturi effect caused by the first airflow. EX-1003 ¶143.

Indeed, the configuration of the enclosure of Aakalu is functionally similar to that of the enclosure of the '521 Patent. A side-by-side comparison of the devices illustrating the airflow during operation of the fan is provided below:



The '521 Patent describes the operation of the cooling device with the fan operating:

the airflow flowing up from the heatsink's convective openings will be heated by the heat dissipated from high powered internal electronics and thus will be significantly more buoyant than the ambient first airflow. As a result, drawing the first airflow across the convective openings of the heatsink will establish a Venturi affect which will pull in more air through the heat sink than would flow naturally due to natural convention.

* * *

The combination of drawing both the heated airflow from the heatsink and the ambient airflow from above is what produces the Venturi effect that generates an increased airflow through the heatsink which in turn draws in relatively cool ambient air in from the bottom side convective openings of the heatsink.

EX-1001 5:66-6:6, 6:8-15; EX-1003 ¶145.

Like the operation of the '521 Patent, a POSA understood in Aakalu that the combination of drawing both the heated airflow from the heatsink (gold) and the ambient airflow from above (blue) is what produces the Venturi effect that generates an increased airflow through the heatsink which in turn draws in relatively cool ambient air in from the bottom side convective openings of the heatsink, Specifically, as the air drawn in through the top ventilators 66 (first airflow) flows into the constricted volume bounded by top panel 26 and top solar shield 52, the flow rate increases and the pressure decreases, and that this Venturi effect will increase the airflow upward through the front heatsink (second (heated) airflow). EX-1003 ¶146.

Thus, Aakalu discloses element [1.3].

Claim 2

The cooling unit of claim 1, wherein the fan shroud is offset from the Venturi chamber such that when the fan is not on, the fan shroud does not obstruct a natural circulation airflow entering the first inlet and exiting the second inlet of the Venturi chamber.

Aakalu explains that front solar shield 50 includes:

top and bottom ventilators 66, 67, such as slots or openings, which align with the longitudinal channels 40 of the front panel 58, thereby allowing for the necessary airflow passage associated with the convection process (i.e., chimney effect) through the longitudinal channels 40.

EX-1005 4:2-7; EX-1003 ¶149.

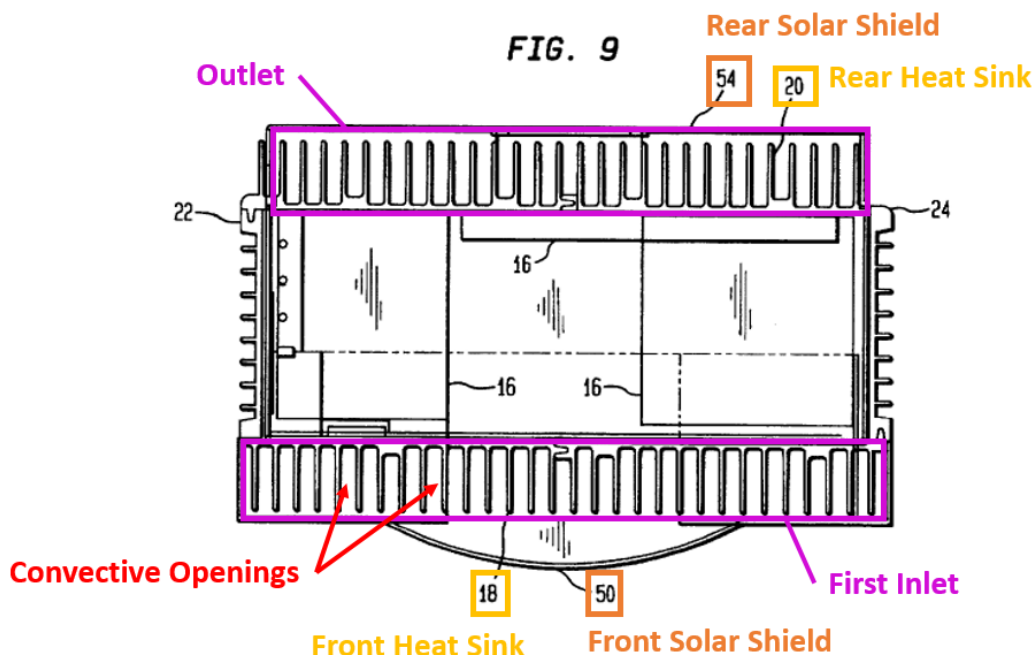
As illustrated, the fan shroud (**light green**) is offset from the Venturi chamber (**purple**) such that the shroud does not obstruct the natural convection airflow (**red**) [*natural circulation airflow*] flowing from the top of the heat sink (**gold**) and entering the adjacent opening (**red-purple**) [*first inlet*] and exiting the top ventilator 66 (**red-purple**) [*second inlet*] of the Venturi chamber. EX-1003 ¶150.

Thus, Aakalu discloses Claim 2.

Claim 4

The cooling unit of claim 1, wherein the Venturi chamber first inlet encircles one or more convective openings of the heatsink.

Aakalu discloses Claim 4. EX-1003 ¶152.



EX-1005 FIG. 9; EX-1003 ¶152.

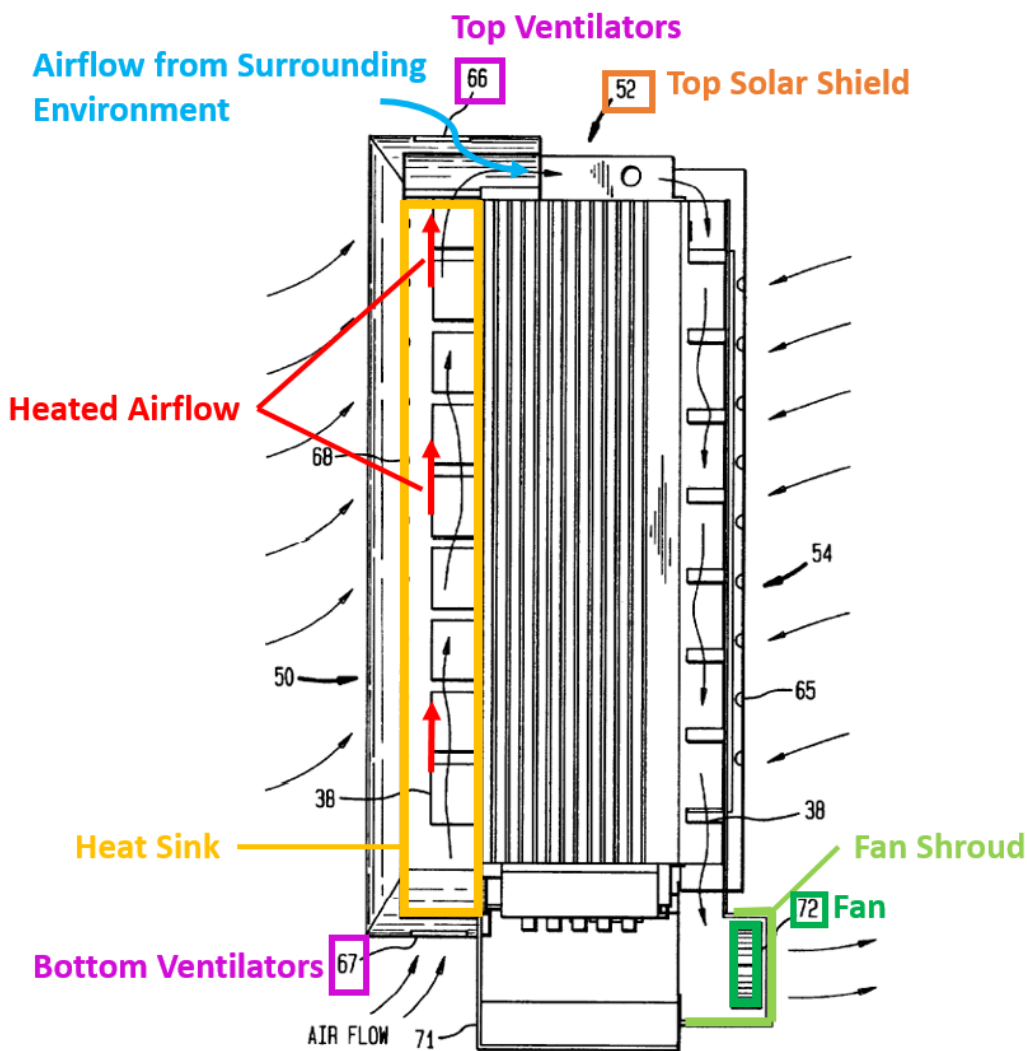
As illustrated in FIG. 9, front heat sink 18 (gold) includes a plurality of convective openings (red) [*one or more convective openings*] at the top of the longitudinal channels 40 formed by adjacent fins of the heat sink. The heated airflow flows out of the convective openings through the inlet (red-purple) adjacent and surrounding the convective openings (red) and over panel 26 [*first inlet encircles one or more convective openings*]. Thus, Aakalu discloses Claim 4.

EX-1003 ¶153.

Claim 5

The cooling unit of claim 1, wherein the airflow from the surrounding environment is cooler than the heated airflow.

Aakalu discloses Claim 5.



EX-1005 Fig. 10; EX-1003 ¶154.

As set forth for element [1.2], the heated airflow (**red**) is drawn into the heat sink through bottom ventilators 67 (**red-purple**) from the same surrounding environment as the airflow (**blue**) drawn into the top ventilators 66 (**red-purple**). The heated airflow absorbs heat as it flows through the heat sink. Thus, a POSA understood that the airflow from the surrounding environment is cooler than the

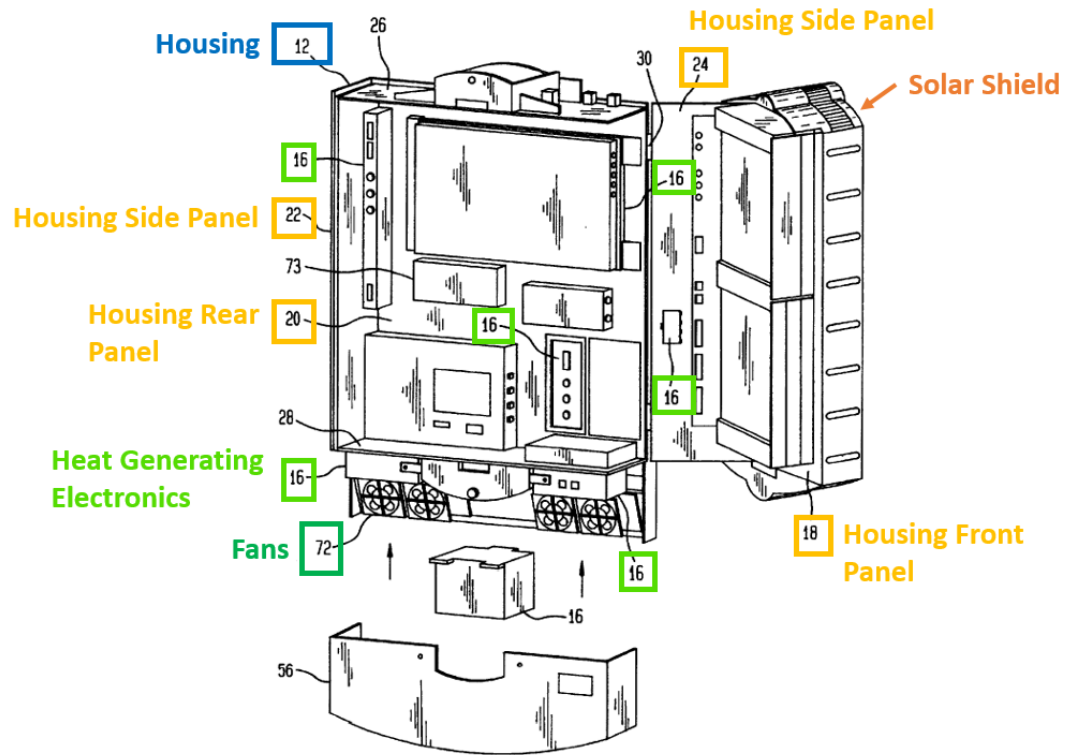
heated airflow that has absorbed heat from the heat sink. EX-1003 ¶155. Hence, Aakalu discloses Claim 5. EX-1003 ¶155.

Claim 14

[14.0] *A method for cooling a sealed environment of an enclosure for housing electronics, the method comprising:*

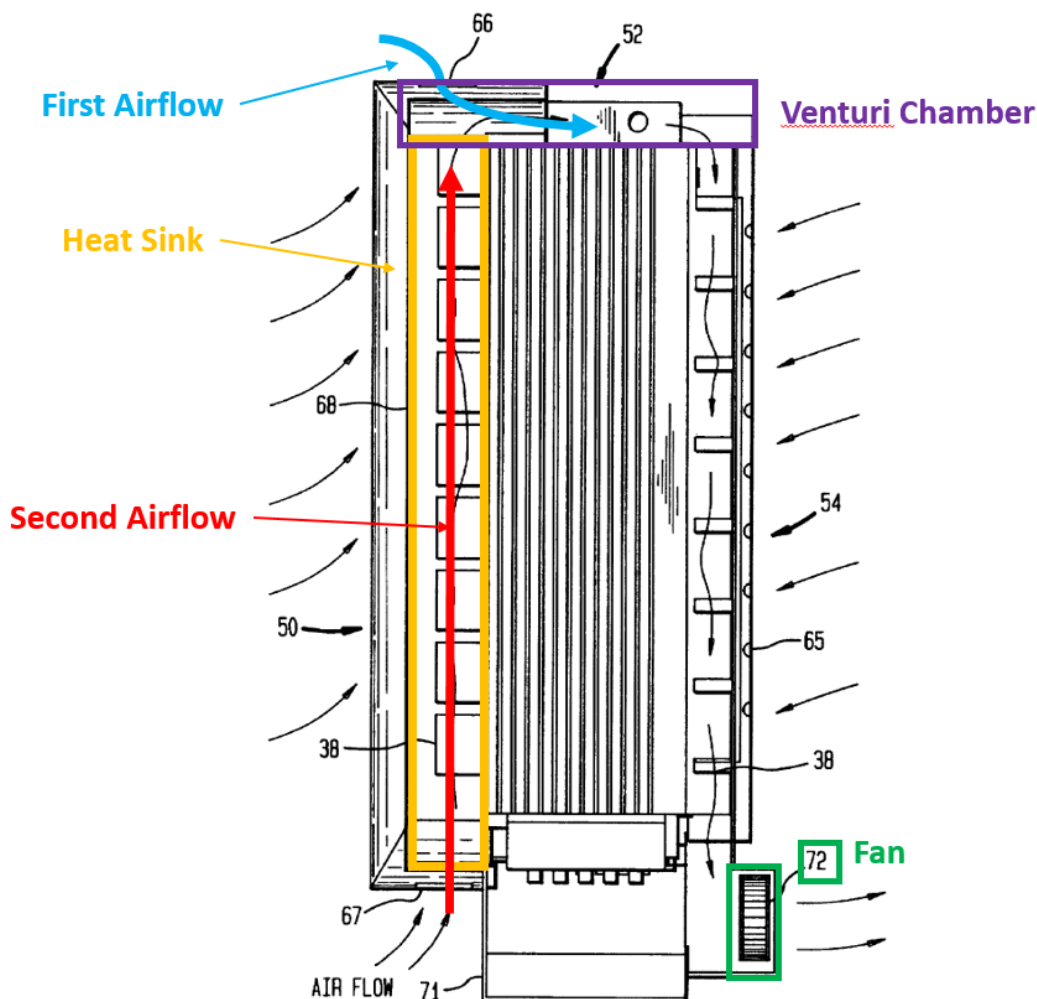
To the extent the preamble is limiting, Aakalu discloses element [14.0] for at least the reasons set forth for element [1.0]. EX-1003 ¶156.

A POSA understood that microcell 10 constitutes *a sealed environment of an enclosure for housing electronics* as recited in element [14.0]. Aakalu states that its disclosure is particularly directed to “outdoor enclosures” and that its housing 12 comprises front panel 18 (**gold**), rear panel 20 (**gold**), and two side panels 22, 24 (**gold**), each of which form heat sinks for absorbing and dissipating heat generated by electronic components 16 (highlighted in **light green** in Fig.2 below) mounted to the interior of the housing panels. EX-1005 1:8-9, 2:59-3:9, FIG. 2; EX-1003 ¶157. A POSA understood that a sealed enclosure is formed when front panel 18 is closed to protect components 16 housed within the enclosure from the outdoor environment. Aakalu also explains that the convective cooling scheme for the housing includes airflow only on the exterior of the sealed housing 12 [*sealed environment*].



EX-1005 FIG. 2; EX-1003 ¶117.

FIG. 10 illustrates the airflow through the microcell during the forced convection method of cooling the electrical components housed within the sealed enclosure:



EX-1005 FIG. 10; EX-1003 ¶157.

Thus, Aakalu discloses element [14.0].

[14.1] directing heat generated by one or more electronic devices housed within a sealed environment of an enclosure to a heatsink thermally coupled to an external environment;

Aakalu discloses element [14.1] for at least the reasons set forth for element [1.2]. EX-1003 ¶159. Aakalu explains that a plurality of electronic components 16 (light green) [one or more electronic devices] are mounted to the interior of the

housing panels (**gold**) [*housed within a sealed environment*] that form heat sinks for absorbing and dissipating heat generated by the components 16 [*directing heat to a heat sink*]. EX-1005 2:59-3:9, FIG. 2; EX-1003 ¶159.

Aakalu further discloses that air from the surrounding environment [*external environment*] is drawn into the heat sink (**gold**) through bottom ventilator 67 and is exhausted to the surrounding environment [*external environment*] by fan(s) 72. EX-1005 4:57-60, 5:3-4; EX-1003 ¶160. Thus, a POSA understood that the heat sink is thermally coupled to an external environment. Hence, Aakalu discloses element [14.1]. EX-1003 ¶160.

[14.2] *drawing a first airflow across one or more convective openings of the heatsink, wherein the first airflow does not flow into the one or more convective openings of the heatsink;*

Aakalu discloses element [14.2] for at least the reasons set forth for elements [1.2] and [1.3]. EX-1003 ¶161. Aakalu discloses that the first airflow (**blue**) is drawn in through top ventilators 66 (**red-purple**) and across the convective openings (**red**) of the longitudinal channels 40 of the heat sink (**gold**). Aakalu further discloses that the first airflow (**blue**) mixes with the heated airflow (red) from the heat sink and is exhausted by fan(s) 72. EX-1005 4:63-5:4; EX-1003 ¶161. Thus, a POSA understood that first airflow (**blue**) does not flow into the convective openings (**red**) of the heat sink. A POSA understood that the operation of the embodiment described by Aakalu with reference to FIGs. 8-10 constitutes

drawing a first airflow across one or more convective openings of the heatsink, wherein the first airflow does not flow into the one or more convective openings of the heatsink as recited in element [14.2]. EX-1003 ¶161.

Hence, Aakalu discloses element [14.2].

[14.3] *drawing a second airflow of heated air from the one or more convective openings using a Venturi effect created by drawing the first airflow.*

Aakalu discloses element [14.3] for at least the reasons set forth for element [1.3]. EX-1003 ¶163. The first airflow (**blue**) [*first airflow*] flowing in through top ventilator 66 and across the convective openings (**red**) [*one or more convective openings*] of the heat sink, draws the heat airflow (**red**) [*second airflow*] from the convective openings using a Venturi effect. EX-1003 ¶163. APOSA understood that the operation of the embodiment described by Aakalu with reference to FIG. 10 constitutes *drawing a second airflow of heated air from the one or more convective openings using a Venturi effect created by drawing the first airflow* as recited in element [14.3]. EX-1003 ¶163.

Thus, Aakalu discloses element [14.3]. EX-1003 ¶164.

Claim 15

[15.0] *The method of claim 14*

[15.1] *wherein drawing the first airflow further comprises drawing the first airflow into a Venturi chamber;*

Aakalu discloses the additional limitations recited in element [15.1] for at least the reasons set forth for elements [1.2], [1.3], and [14.2]. EX-1003 ¶165.

[15.2] *wherein drawing the second airflow further comprises drawing the second airflow into the Venturi chamber;*

Aakalu discloses the additional limitations recited in element [15.2] for at least the reasons set forth for elements [1.2], [1.3], and [14.3]. EX-1003 ¶166.

[15.3] *the method further comprising operating a fan to pull the first airflow and the second airflow out of the Venturi chamber.*

Aakalu discloses the additional limitations recited in element [15.3] for at least the reasons set forth for elements [1.2], [14.2], and [14.3]. EX-1003 ¶167.

Thus, Aakalu discloses Claim 15. EX-1003 ¶168.

Claim 16

The method of claim 14, further comprising operating a fan to draw the first airflow and the second airflow.

Aakalu discloses the additional limitations recited in Claim 16 for at least the reasons set for elements [1.2], [14.2], and [14.3]. EX-1003 ¶169.

Claim 17

The method of claim 15, wherein the fan is located offset with respect to the Venturi chamber to not impede a natural circulation of airflow through the Venturi chamber when the fan is not in operation.

Aakalu discloses the additional limitations recited in Claim 17 for at least the reasons set forth for elements [1.2], [14.2], and [14.3], and Claim 2. EX-1003 ¶170.

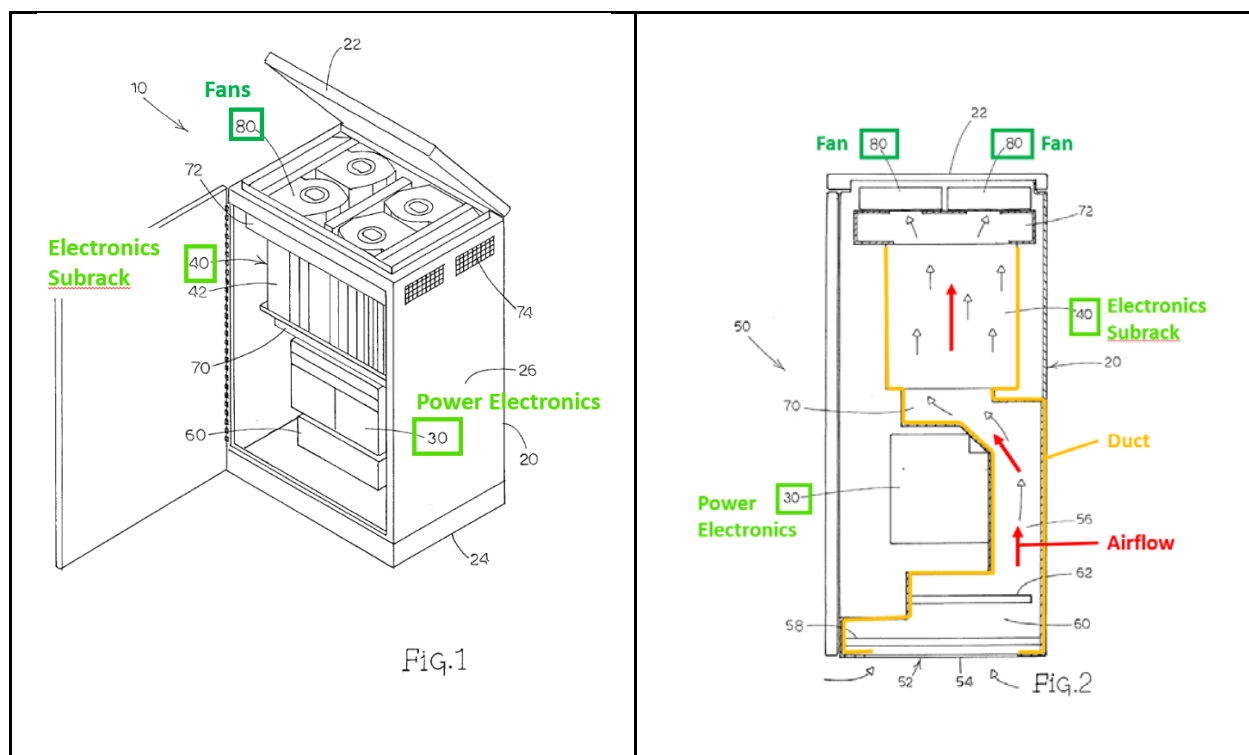
C. Challenge 3: Claims 3 and 18-20 are obvious over Aakalu in view of Jones

1. Jones

Jones is titled “Electronics Cabinet Cooling System” and discloses a “cabinet for housing telecommunications equipment in outdoor locations.” EX-1006 Title, Abstract. Jones explains that the cabinet includes an enclosure housing electronics and a cooling system including a duct having inlet and outlet plenums and one or more fans forming a segregated air routing system. EX-1006 2:15-38; EX-1003 ¶171.

Jones further explains that the cooling system includes a thermal controller for monitoring the temperature within the cabinet and controlling operation of the fans and a heater. EX-1006 2:39-41; EX-1003 ¶172.

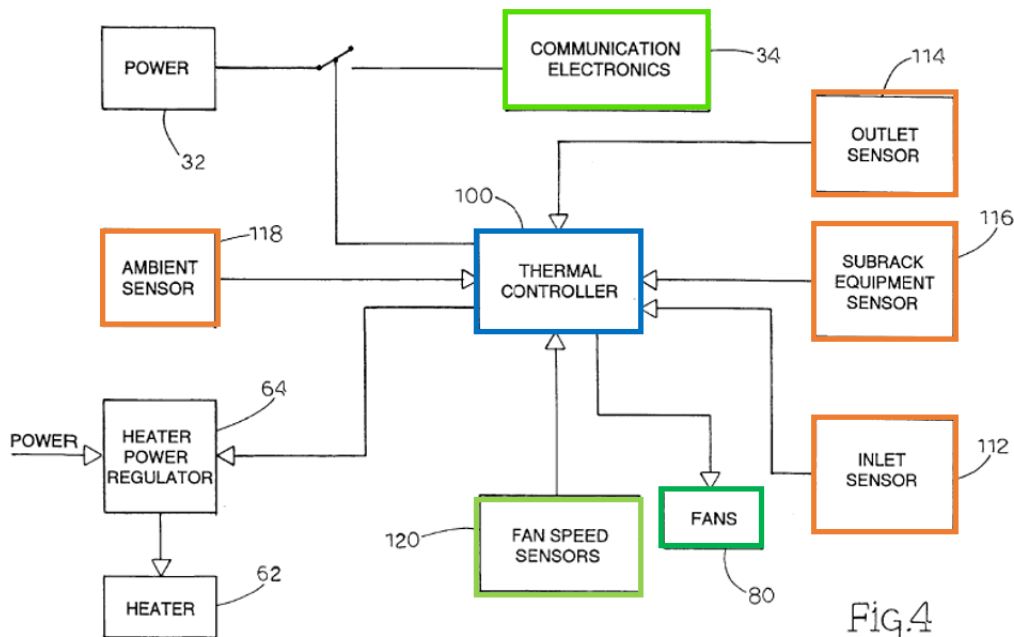
FIGs. 1 and 2 illustrate a perspective view and section view of the cabinet.



EX-1006 FIGs. 1, 2; EX-1003 ¶173.

Jones explains that cabinet 10 includes cooling system 50 for cooling the electronics housed therein (e.g., communications electronics 34 in the subrack 40 (light green)) by providing an airflow (red) through the ducting (gold) within the cabinet. A plurality of fans 80 (green) draw the air through the ducting. EX-1006 3:40-55; EX-1003 ¶174.

Jones, with reference to Fig. 4 below, further explains that a thermal controller 100 (blue) controls the operation of the fans 80 (green) and a heater 82 responsive to input from temperature sensors (orange) and fan speed sensors (light green). EX-1006 4:53-57; EX-1003 ¶175. FIG. 4 is a block diagram of the thermal control system.



EX-1006 FIG. 4; EX-1003 ¶175.

Jones explains that controller 100 controls the airflow through the cooling system and the power of the heater 62 to maintain the temperature of the cooling air supplied to the electronics. The on/off state of one or more of the fans, and the speed of the fans when on is controlled by controller 100 responsive to the sensed temperatures. EX-1006 5:5-42; EX-1003 ¶176.

Jones also discloses that one fan 80 from the plurality of fans be held in reserve as a redundant backup. EX-1006 4:46-51; EX-1003 ¶177.

2. Detailed Application of Aakalu and Jones to the Challenged Claims

Claim 3

The cooling unit of claim 1, wherein the at least one electrical fan includes a primary fan and a backup fan that becomes operational upon a failure of the primary fan.

Aakalu in view of Jones renders Claim 3 obvious. Aakalu discloses using a plurality of fans to affect a forced convection cooling scheme for an enclosure housing electronics, but does not expressly state that that one of the fans is a backup fan in the event of a failure of a primary fan. However, Jones expressly teaches using one of the plurality of fans as a backup. EX-1003 ¶178.

Both Aakalu and Jones describe that communications electronics within the electronic equipment cabinet should be cooled to help prevent malfunctions or damage and this is particularly true for electronic equipment cabinets in locations that are not in temperature controlled environments, such as outdoor environments. EX-1005 1:15-30; EX-1006 3:40-45; EX-1003 ¶179. As a solution to prevent damage to electronic components, both Aakalu and Jones teach the use of variable speed fans to provided adequate air flow to maintain the temperature of the electronic components in a safe range. EX-1005 5:5-10; EX-1006 4:40-43; EX-1003 ¶179. Jones discloses using a plurality of fans and expressly teaches that “[t]o provide a redundant backup [*backup fan*], it is preferred that one fan 80 be held in reserve” so that if one of the main fans 80 [*primary fan*] is not operating properly, the reserve fan may be substituted for the malfunctioning fan [*backup fan that becomes operational upon a failure of the primary fan*]. EX-1006 4:46-51;

EX-1003 ¶179. A POSA would be motivated to modify the teachings of Aakalu to use a plurality of variable speed fans with the teachings of Jones to maintain at least one of the fans in reserve as a backup in order to provide redundancy and prevent damage to the electronics in the event of a failure of a primary fan. Thus, Jones provides the express motivation to provide redundancy to critical cooling systems like Aakalu by using one of the plurality of fans as a back-up fan. Moreover, it was within the knowledge and skill of a POSA to design the cooling system with appropriately sized fans to provide sufficient cooling using primary or backup fans such that a POSA understood that implementing redundancy would be successful. EX-1003 ¶179.

Thus it was obvious to a POSA to modify the teachings of Aakalu to include one backup fan for redundancy as taught by Jones. Hence, Claim 3 is obvious over Aakalu in view of Jones. EX-1003 ¶180.

Claim 18

The method of claim 15, further comprising operating the fan when a temperature exceeds a predetermined threshold.

Aakalu alone or in view of Jones renders Claim 18 obvious. EX-1003 ¶181. Aakalu teaches that its cooling system operates in two modes: (1) a natural convection mode with the fans not operating, or (2) a forced convection mode with the fans operating. EX-1005 3:25-34; EX-1003 ¶181. Aakalu also teaches that the amount of fresh air drawn into the microcell may be controlled by the size of the

ventilators and the speed of the fans. In one embodiment, the size of the ventilators is controlled to control the temperature of the cooling airflow. EX-1005 5:5-30; EX-1003 ¶181.

Although Aakalu does not expressly describe transitioning from natural to forced convection mode by operating the fans when temperature exceeds a predetermined threshold, a POSA understood that temperature rising above a predetermined threshold in a natural convection mode indicates that natural convection is not adequate under the present conditions to prevent overheating the electronics such that forced convection is necessary by operating the fans. EX-1003 ¶182. Specifically, Aakalu expressly teaches that the speed of the fan can be used to control the amount of fresh air drawn in and thus, if natural convection alone is not drawing in sufficient fresh air, a POSA would switch to forced convection mode to prevent damage to electrical components. EX-1005 5:5-30; EX-1003 ¶182. Thus, a POSA understood that Aakalu discloses this limitation.

To the extent that PO argues that Aakalu does not expressly state that switching from natural convection mode to forced convection mode is performed when a temperature exceeds a predetermined threshold, Jones discloses this limitation. Jones expressly teaches that the fans in a forced convection cooling system may be controlled based on sensed temperatures, including the on/off state of a fan. EX-1006 5:5-42; EX-1003 ¶183. Jones teaches that the capacity and

number of fans should vary depending on the desired capacity of the cooling system and that each fan should be variable speed over a wide range of speeds and that the speed of the fan was controlled by a thermal controller that received temperatures from a temperature sensor at the rack holding the electronic components based on predetermined temperature ranges. EX-1006 4:40-61; 5:20-42; EX-1003 ¶183. Further, Jones describes that the fans can be turned on or off and each includes a backdraft damper to prevent recirculation of cooling air through any fans that are not in use. EX 1006 4:43-46; EX-1003 ¶183. Thus, a POSA understood that fans could be turned on and off as necessary based on the sensed temperatures of the electronic components. EX-1003 ¶183.

Thus, a POSA would be motivated to modify the teachings of Aakalu to operate a fan when the temperature exceeds a predetermined threshold as taught by Jones to prevent overheating the electronics, e.g., to operate the fans when natural convection is no longer sufficient to maintain the temperature below a safe threshold. In addition, a POSA understood that operating the fan when a temperature exceeded a predetermined threshold conserved power and reduced wear on the fans when forced convection is not necessary. As demonstrated by Jones, it was well within the skill and knowledge of a POSA to sense the critical temperature(s) within the system of Aakalu and control the fan(s) responsive to the sensed temperature(s). EX-1003 ¶184.

Thus, it was obvious to a POSA to modify the teachings of Aakalu to include the temperature control of the fans as taught by Jones. Hence, Claim 18 is obvious over Aakalu alone and/or in view of Jones. EX-1003 ¶185.

Claim 19

[19.0] *A method for cooling a sealed environment of an enclosure for housing electronics, the method comprising:*

Aakalu discloses element [19.0] for at least the reasons set forth for elements [1.0] and [14.0]. EX-1003 ¶186.

[19.1] *directing heat generated by one or more electronic devices housed within a sealed environment of an enclosure to a heatsink thermally coupled to an external environment;*

Aakalu discloses element [19.1] for at least the reasons set forth for element [14.1]. EX-1003 ¶187.

[19.2] *when a temperature exceeds a first predetermined threshold, operating a fan to draw a first airflow across one or more convective openings of the heatsink and a second airflow of heated air from the one or more convective openings of the heatsink using a Venturi effect created by drawing the first airflow, wherein the first airflow does not flow into the one or more convective openings of heatsink;*

Aakalu discloses and/or renders obvious element [19.2] alone and/or in view of Jones for at least the reasons set forth for element [14.2] and Claim 18. EX-1003 ¶188.

[19.3] *when the temperature does not exceed a second predetermined threshold, allowing a natural circulation*

airflow to flow from the one or more convective openings of the heatsink by not operating the fan.

Aakalu discloses and/or renders obvious element [19.3] alone and/or in view of Jones for at least the reasons set forth for element [14.3] and Claim 18. EX-1003 ¶189.

Claim 20

The method of claim 19, wherein the fan is located such as to not impede the natural circulation airflow when the fan is not in operation.

Aakalu discloses the additional limitations recited in Claim 20 for at least the reasons set forth for Claim 17. EX-1003 ¶190.

VIII. The Board Should Not Exercise Its Discretion To Deny Institution

A. The Board Should Not Deny Institution Under 35 U.S.C. § 325(d)

When determining whether to exercise discretion under § 325(d), “the Board uses the following two-part framework: (1) whether the same or substantially the same art previously was presented to the Office or whether the same or substantially the same arguments previously were presented to the Office; and (2) if either condition of first part of the framework is satisfied, whether the petitioner has demonstrated that the Office erred in a manner material to the patentability of the challenged claims.” *Advanced Bionics, LLC v. MED-EL Elektromedizinische Geräte GmbH*, IPR2019-01469, Paper 6, p. 8 (Feb. 13, 2020) (designated: March 24, 2020).

Denial under § 325(d) is not warranted because the challenges presented in this Petition are neither cumulative nor redundant to the prosecution of the Challenged Claims.

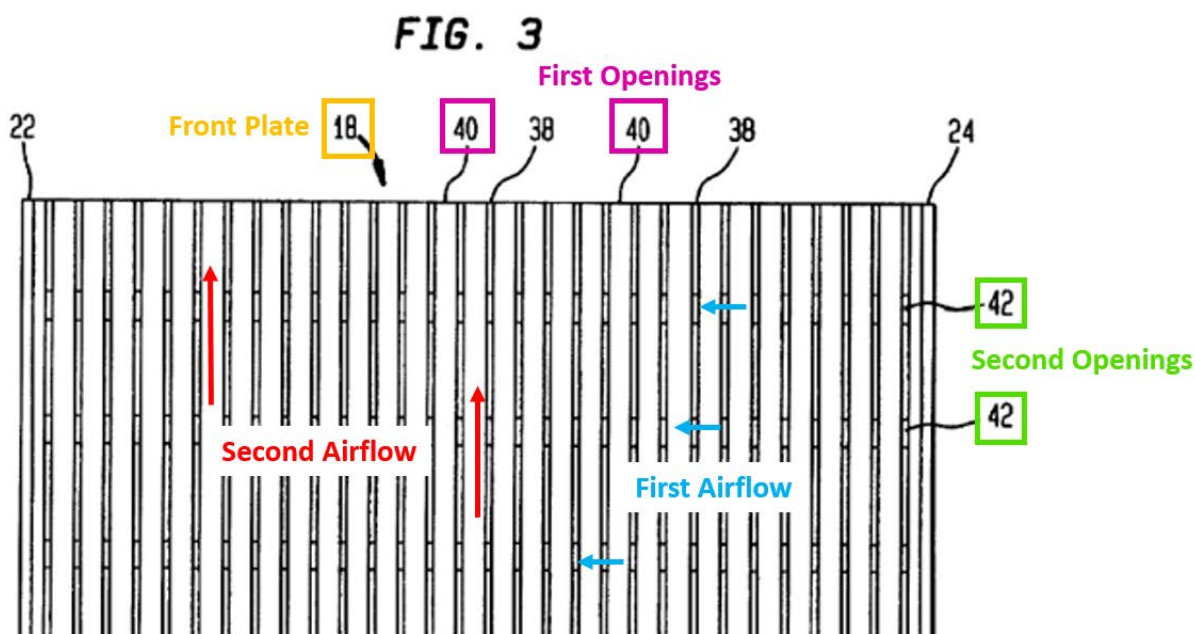
As discussed in Section V.B, in rejecting Claims 14-20 as obvious, the Examiner stated:

Aakalu teaches the broad method for cooling an enclosure 10 for housing electronics, the method comprising: ... drawing a first airflow [blue] across (as air flow crosses into the channel/opening 40 through channel 42 [*second opening* (green)] as seen in Fig. 3) one or more convective channels/openings 40 of the heat sink/plate 32 (rear wall 20)²; drawing a second airflow [red] (the airflow coming up through the channel/opening 40 [*first opening* (pink)] from the bottom of the plate 32/rear wall 20 in Fig. 3) of heated air from (heated air goes out the top of the channel(s)/opening(s) 40) the one or more convective channels/openings 40 using a Venturi effect created by drawing the first airflow. The Venturi chamber is considered the channel(s)/opening(s) [i.e., *first opening(s)* 40 (pink) and *second opening(s)* 42 (green)] with the offset fan being one of the fans 72 to force the first and second airflow out of the Venturi chamber.

EX-1002 53-54.

² The Examiner appears to mistakenly reference front wall 18 depicted in FIG. 3 as rear wall 20.

The Examiner's application of Aakalu to the claims is illustrated in annotated FIG. 3 below:



EX-1005 FIG. 3 (upper portion)

In response, Applicant amended independent Claims 14 and 19 to add the limitation “*wherein the first airflow does not flow into the one or more convective openings of the heatsink*” and specifically argued Aakalu is deficient in teaching this newly added limitation. EX-1002 33-34.

The Examiner subsequently withdrew the rejection and allowed the claims. EX-1002 10-11.

However, even after the amendment, the claims still read on Aakalu as set forth in Ground 2. It was error for the Examiner not to consider the full teachings

of Aakalu as set forth in Ground 2, which demonstrates that Aakalu does disclose the limitation added by amendment that Applicant argued was missing in Aakalu.

It was further error for the Examiner to conclude that Aakalu does not teach a sealed enclosure. As set forth in Ground 2, Claim 14, Aakalu discloses this element.

Thus, even though the art presented in Ground 2 was before the examiner, the arguments (and supporting testimonial evidence) presented in this Petition were not before the Examiner, demonstrating that the examiner erred in his interpretation of the art. Therefore, the Board should not deny institution under § 325(d).

The subject matter of Sterner was disclosed by Applicant in an IDS, but the Examiner did not cite nor discuss Sterner during prosecution. Thus, Sterner was not materially considered by the Office. As set forth in Ground 1, Sterner discloses all of the elements recited in at least Claims 1 and 14. Thus, it was error for the Examiner to not apply Sterner as demonstrated in this Petition.

B. The Board Should Not Deny Institution Under 35 U.S.C. § 314(a)

Under *Fintiv*, the Board takes a holistic view of whether efficiency, fairness, and the merits support the exercise of authority to deny institution in view of an earlier trial date in the parallel proceeding. *Apple Inc. v. Fintiv, Inc.*, Case IPR2020-00019, Paper 11 at 6 (March 20, 2020).

According to the latest guidance from the Director:

The Board should first assess Fintiv factors 1–5; if that analysis supports discretionary denial, the Board should engage the compelling merits question. If the Board reaches the compelling merits analysis and finds compelling merits, it shall provide reasoning to explain its determination.

CommScope Techs. LLC. V. Dali Wireless Inc. IPR2022-01242, Paper 23 at 6 (February 27, 2023).

Factor 1 is neutral because no request for stay has been filed.

Under factor 2, trial has been set for October 20, 2025. A Final Written Decision is expected in the present matter in June 2026. However, given the variability of trial schedules, this factor is neutral.

Factor 3 favors institution. The co-pending litigation is in its early stages, and the investment in it has been minimal. Thus, this factor weighs against discretionary denial.

Factor 4 weighs against discretionary denial, Petitioners stipulate that if the IPR is instituted, it will not pursue the same grounds in the district court litigation. *Sand Revolution II LLC v. Continental Intermodal Group – Trucking LLC*, IPR2019-01393, Paper 24 at 7 (June 16, 2020) (informative). In addition, PO has only identified in the Complaint a subset of the claims that are being challenged in the present Petition.

Under factor 5, Petitioners are defendants in the Related Litigation and thus this factor is neutral.

Assessing *Fintiv* factors 1–5, the Board should find that discretionary denial is not supported. Nevertheless, should the Board reach the compelling merits question, the merits of the Petition are particularly strong.

Under factor 6, other circumstances weigh in favor of institution. Here, as described in Grounds I, II and III above, the merits of the Petition are particularly strong and compelling. For example, both Sterner and Aakalu individually disclose a cooling unit utilizing the venturi effect to draw ambient air through the heatsink to cool electronic components as claimed in the '521 Patent. The evidence presented, if unrebutted in trial, would plainly lead to a conclusion that one or more claims are unpatentable by a preponderance of the evidence.

When viewed holistically, the efficiency, fairness, and the merits support instituting review.

IX. Mandatory Notices Under 37 C.F.R. §42.8

A. Real Party-in-Interest (37 C.F.R. § 42.8(b)(1))

The real parties-in-interest in this Petition are Ericsson Inc., Telefonaktiebolaget LM Ericsson, and Cellco Partnership d/b/a Verizon Wireless. No other parties have directed, funded, or controlled the filing of this IPR, and this IPR was not filed at the behest of any other party.

Additionally, out of an abundance of caution in light of prior challenges to the named real parties-in-interest in separate and unrelated IPR petitions, Verizon Wireless further identifies Verizon Communications Inc. and Verizon Corporate Resources Group LLC as real parties-in-interest for the IPR requested by this Petition, solely to the extent that Patent Owner contends that these separate legal entities should be named real parties-in-interest in the requested IPR, and Verizon Wireless does so to avoid the potential expenditure of resources to resolve such a challenge. Also, Verizon Wireless notes that Verizon Wireless has several hundred affiliated entities and each of these entities agrees to be estopped under the provisions of 35 U.S.C. §315 as a result of any final written decision in the requested IPR to the same extent that Verizon Wireless is estopped.

B. Related Matters (37 C.F.R. § 42.8(b)(2))

1. Judicial Matters

As of the filing date of this Petition and to the best knowledge of Petitioners, the '521 Patent is involved in the following litigation:

- *Procomm Int'l PTE LTD v. Verizon Commc'ns, Inc. et al.*, Case No. 2:24-cv-009-RWS-RSP (E.D. Tex) (filed Jan. 8, 2024) (ongoing).

2. Administrative Matters:

As of the filing date of this Petition and to the best knowledge of Petitioners, the '521 Patent has not been subject to any *inter partes* review, *ex parte* reexamination, or *inter partes* reexamination

3. Related Patents

As of the filing date of this Petition and to the best knowledge of Petitioners, there are no patents or patent applications claiming, or which may claim, the benefit of the priority of the filing date of the '521 Patent.

C. Lead/Back-up Counsel (37 C.F.R. § 42.8(b)(3)):

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D. Notice of Service Information (37 C.F.R. § 42.8(b)(4)):

Please direct all correspondence to lead and back-up counsel at the above addresses and DC-IPdocketing@duanemorris.com. Petitioners consent to electronic service at the email addresses above.

X. CONCLUSION

Petitioners have established a reasonable likelihood of prevailing with respect to all Challenged Claims of the '521 Patent and requests the Board institute *inter partes* review and cancel all claims.

Respectfully submitted,

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Dated: December 31st 2024

CERTIFICATION OF SERVICE ON PATENT OWNER

Pursuant to 37 C.F.R. §§ 42.6(e), 42.8(b)(4) and 42.105, the undersigned certifies that on the 31st of December 2024, a complete and entire copy of this Petition for *Inter Partes* Review of U.S. Patent No. 7,724,521 and all supporting exhibits were served via Federal Express, postage prepaid, to Procomm International PTE. LTD. by serving the correspondence address of record for the ‘521 Patent.

200313 - PROCOMM INTERNATIONAL-Patents and Licensing LLC
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TAIWAN

Curtesy copies were also served on litigation counsel at the following email addresses:

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CERTIFICATE OF COMPLIANCE

Pursuant to 37 C.F.R. § 42.24 *et seq.*, the undersigned certifies that this document complies with the type-volume limitations. This document contains 13994 words as calculated by the “Word Count” feature of Microsoft Word 2010, the word processing program used to create it.

Dated: December 31st, 2024

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